State of California | The Resources Agency of California

M e m o r a n d u m

To: Commissioner Geesman
Commissioner Boyd

Date : August 31, 2005

Via: B.B. Blevins

Telephone: CALNET (916) 654-4024
(916) 654-4703

From: **California Energy Commission Melinda Dorin and Linda Spiegel**
1516 Ninth Street
Sacramento CA 95814-5512

Through: **Martha Krebs and Terry O'Brien**

Subject: **Response to public comments on the staff report titled *Assessment of Avian Mortality from Collisions and Electrocutions* (CEC-700-2005-015) (Avian White Paper) written in support of the 2005 Environmental Performance Report and the 2005 Integrated Energy Policy Report**

Staff has reviewed comment letters provided to date in response to the Avian White Paper and the Environmental Performance Report Workshop held on June 28, 2005; five of the letters were from the wind industry and their consultants – including comments from SMUD, PPM, CalWEA and KWEA, Carol Weisskopf, and California Wind Companies. The latter also included comments by the wind companies' environmental consultant, WEST, Inc. The balance of the letters are generally supportive of the staff report, and include letters from the Department of Fish and Game, U.S. Fish and Wildlife Service, several environmental groups and avian researchers, and the general public. Many of the letters were submitted in response to the letters filed by wind industry representatives. Some of the comments were received as a result of the co-authors' (Thelander) solicitation of input from interested stakeholders.

The following is a summary of the staff response (attached) to industry comments prepared by Energy Commission staff Melinda Dorin and Linda Spiegel, and staff's consultant, Dr. Shawn Smallwood, who is the lead scientist and lead author of the 2004 PIER-funded report, *Developing Methods To Reduce Bird Mortality In The Altamont Pass Wind Resource Area* (P500-04-052).

General Comments

Within the industry comment letters, there are some common issues. Those issues include concern about scientific methodologies used in the PIER-sponsored research *Developing Methods to Reduce Bird Mortality in the Altamont Pass Wind Resource Area* (August 2004), the Energy Commission's various processes that have addressed avian impact and mortality issues, and public and stakeholder participation in the Energy Commission's various forums. The industry focus is primarily on the 2004 PIER-sponsored report rather than the current staff work in the 2005 Environmental Performance Report and the Avian White Paper.

Comments from the wind industry are critical and question the integrity of the Energy Commission program's scientific assessment and mitigation development work on avian – wind energy issues. The industry comments selected particular references to support their conclusions while often ignoring other important facts and scientific arguments that are well documented in the public and scientific record. In responding to these comments, staff seeks to clarify the record regarding the program's wind-avian research and its efforts to engage in cooperative participation with the wind industry and Alameda County to address and resolve important avian mortality issues relative to existing wind farms in California.

Specific Comments

Staff has drafted specific, detailed responses to issues raised by the industry. The following is a summary of these major issues and a corresponding staff response:

2004 PIER Report. Many industry comments questioned the basis and use of mortality estimates, and argued that mitigation measures are therefore uncertain and should not be implemented until proven. The operators insist that data from a set of turbine strings be omitted because they inflate mortality estimates, and they imply that these inflated mortality estimates are the basis of the predictive avian risk-assessment models applied to wind turbines. *Mortality estimates however, are not the basis for the associations* in the risk-assessment models developed for predicting fatalities at wind turbines.

Mortality estimates and fatalities are two separate metrics used for different purposes. Fatalities are simply the number of turbine-caused deaths at each wind turbine. Mortality is a rate; in this case the rate of fatalities over time. Mortality estimates are useful for understanding the magnitude of avian deaths and for comparisons between wind farms. The PIER 2004 Report emphasized that three years of monitoring data are required to reliably predict *mortality estimates.* The Report also made it clear that more sampling would improve the precision of the mortality estimate but the arithmetic mean may not change.

The 2004 PIER report was careful to use actual *fatality* data (as opposed to mortality estimates) in the statistical analysis to infer causal factors associated with bird collisions. These analyses were based on over 32,000 searches and 1,200 actual fatalities. Because of the statistical significance of these databases, adding more length to the study would not likely change the pattern of fatalities among categories or levels of each environmental variable which were used to determine risk factors.

Some turbines were monitored for a shorter period of time. The fatalities of two raptor species recorded among this second set of turbines during that shorter sampling period were more numerous than fatalities recorded elsewhere during the entire preceding four-year period. The industry did not grant access to these apparently more dangerous turbines until near the end of the study. Excluding this information would have resulted in significant underestimates of mortality and more research will not appreciably change the conclusion that the level of bird kills is significant.

It should also be noted that the industry consultants have used the 2004 PIER Report mortality estimates in preparing their own environmental assessments of wind projects.

Industry comments attempt to cast doubt on the analysis in the 2004 PIER Report by suggesting that many fatalities were not caused by moving turbine blades, but in fact may be caused by natural mortality or collisions with other objects. A careful review of the 2004 PIER report, as well as most other reports on avian mortality, collision-based or otherwise, easily refutes this argument. First, most fatalities caused by collision with moving blades show injuries specific to this source such as severed body parts and torsos cut in half. *Secondly, fatalities that could not be attributed to turbine blade collision were omitted from the analysis.* Raptors are agile flyers with keen eyesight and there is little documented evidence to suggest they regularly collide with stationary objects. They do collide with mobile objects such as wind turbine blades and moving vehicles. Small birds, or passerines, show a tendency to collide with stationary objects such as communication towers and buildings with reflective or lighted windows, mostly during night-time migratory events and inclement weather.

Staff agrees with the industry that mitigation cannot be proven until implemented and monitored. While the industry argues that the effectiveness of winter shut-down of turbines is unproven, this is actually the mitigation measure being proposed by the industry (WEST 2005). Staff only provided an assessment, as requested by them, of this proposed measure as well as of the most dangerous turbines that operators should consider shutting down or removing.

Environmental Performance Report public process and participation. The purpose of releasing the Avian White Paper, conducting the public workshop, and the process of soliciting public comment was designed to solicit full and adequate public review. The following summarizes this process:

- Staff presented its scope of work at the November 15, 2004 Scoping Workshop and written comments were requested by November 29, 2004.
- Staff released the Avian White Paper for public review and comment on June 13, 2005.
- Staff invited industry to speak and be a part of the panel discussion at the June 28, 2005 workshop to make sure their comments and viewpoints were part of the public process.
- Staff requested written comments from workshop participants and the IEPR Committee extended the comment period to accommodate industry requests to do so from July 15 to July 29, 2005.
- As part of the public process, the California Wind Companies (APWRA industry group) provided a 93-page comment letter which staff has responded to in the attachment to this memorandum. In addition, industry representatives provided four other lengthy comment letters.
- The Altamont Wind Industry group and their consultants had an opportunity to review the draft 2004 PIER Report and provided comments, which Smallwood and staff responded to again as part of this process (see WEST Comments).

Energy Commission staff prepared the 2005 Avian White Paper to summarize the status of avian impact research in the State and to develop findings and potential policy options to be discussed in a public workshop on June 28, 2005. Staff relied on a large body of knowledge throughout the report to substantiate their findings and policy proposals. This body of knowledge is a 20-year record of increasingly refined scientific field work and analysis by staff, consultants and independent researchers to understand, document and reduce the levels of avian fatalities from wind turbines. As voiced by the Alameda County representative at the June 28 workshop, other government entities and agencies rely on the work of Energy Commission research program results and the staff to help them understand avian mortality issues and potential solutions.

Peer or public review of PIER and Staff Reports. During the PIER sponsored Altamont study, industry representatives were given an opportunity to review the project scope/scientific methodology, periodic progress briefings and provided an opportunity to review and comment on *all* interim products. Industry representatives were also provided with a pre-public release of the PIER 2004 Report for review and comment. Thus, industry has had continuous opportunities to review and comment on the wind-avian research. In addition, the review process for the final report solicited comment by outside scientists in a manner comparable to the "peer review process" practiced by most scientific journals.

One of industry's primary complaints is the lack of a public review process for the 2004 PIER Report. This complaint is not supported by fact or written record, as evidenced by attachments to the owners' own comments, including their own reviews of our commission-published 2004 PIER Report prior to final release. Staff engaged the industry throughout the entire process. This engagement is described by Florida Power and Light's own declaration to Superior Court (dated two days earlier than their comment letter to CEC), which states that it has been actively involved in an collaborative effort with CEC to mitigate avian impacts at the Altamont Pass for the past five or so years.

All CEC-controlled data have been provided as requested to members of the wind industry. As mentioned previously, the draft final report was also sent out for advance review, including the following industry and agency representatives:

Rick Koebbe, President PowerWorks Inc.
William Damon Vice President PowerWorks, Inc
Robert Szymanski, Vice President PowerWorks, Inc
Steven Steinhour, Vice President SeaWest
Steve Ponder, Vice President Florida Power and Light
Joan Stewart Permits and Environmental Affairs Florida Power and Light
Jim Lindsay, Florida Power and Light
Tara Dinman, Florida Power and Light
Rebecca Perree. Florida Power and Light
Rich Piper, Florida Power and Light
Ed Taylor, Project Manager Global Renewable Energy Partners
George Hardie, Owner G3 Energy

Eric Newell, Enron
Jeff Welton Wintec Energy
John Schwartz, Silcon Valley Power
Kelly Lard, Enxco
Dale Strickland, WEST, Inc
Wally Erickson, WEST, Inc
Darryl Gray Assistant Planning Director Alameda County
Andrew Young, Planner Alameda County
David Brockbank, Contra Costa County
Scott Heard Resident Agent in Charge, U.S. Fish and Wildlife Service
Larry Butcher, Biologist, U.S. Fish and Wildlife Service
Janice Gan, Biologist, California Department of Fish and Game
Ron Jurek, Biologist, California Department of Fish and Game
Sarah Calzada, Biologist, California Department of Fish and Game.

After the stakeholders reviewed the draft 2004 PIER Report, staff distributed it for further peer review to independent researchers. This is similar to the peer review process of scientific journals. In addition, many research papers are now being prepared for submittal to scientific journals; therefore, the results and underlying methodology will receive further peer review through that standardized process.

In fall 2004, Alameda County formed a Working Group, including Commission staff, to address ongoing avian issues at Altamont. Comments provided by the industry allege that staff assessments provided to the Alameda County Working Group were unexpected and deviate from conclusions provided in the 2004 PIER Report. In fact, subsequent staff mitigation plan assessments were requested by the industry and Alameda County during the Working Group proceedings. These assessments were completed as a cooperative and collaborative effort to assess various mitigation scenarios provided to the working group by the industry. These assessments represented a good faith effort by staff to assist stakeholders in developing an equitable solution. Although these assessments were completed and circulated to the Working Group in January, March and early June of 2005, no comments were received by staff prior to the issuance of the 2005 Avian White paper.

These staff assessments of industry-proposed mitigation scenarios do not provide results that deviate from the PIER 2004 report. They use the PIER 2004 Report fatality data to assess the effectiveness of a seasonal shut down that was proposed by the industry. The scenarios used are based upon criteria requested by the industry to take non-biological factors into consideration and the basis for each assessment is clearly stated in the introduction of each report.

Attachments:
Staff Response to Comments from the California Wind Companies (CWC)
Staff Response to Comments from CWC's Attachment 7
Staff Response to Comments from CWC's Attachment 9
Staff Response to Comments from Carol Pilz Weisskopf, PhD
Staff Response to Comments from CalWEA and KWEA
Staff Response to Comments from SMUD
Staff Response to Comments from PPM Energy

Summary Supplemental Staff Response to CalWEA August 9, 2005 letter to the California Energy Commission from Nancy Rader

The California Wind Energy Association (CalWEA) provided a second set of comments (dated August 9, 2005) for consideration in the IEPR process. This most recent submittal, as with their first set of comments, focused on the PIER-sponsored 2004 Smallwood and Thelander report on methods to reduce avian mortality at the Altamont Pass wind resource area.

The August 9th comment letter raises concern about the underlying assumptions and protocol used in the 2004 Smallwood and Thelander report. However, the reviewers appear to be unfamiliar with common practices used to conduct this type of avian mortality research and we identified several errors in their analysis. The unfamiliarity may be due, in part, to the fact that the author of those comments (C. Pitz Weisskopf) is trained as an agricultural and environmental chemist and not in an ecological-related field.

The cover letter to these comments claim that the Smallwood and Thelander study did not follow recognized guidelines of the National Wind Coordinating Committee (Anderson et al 1999). Two of the four principal authors of the National Wind Coordinating Committee report collaborated closely with PIER researchers in designing the studies. They are Dr. M. Morrison (Professor and Caesar Kleberg Chair in Wildlife Ecology and Conservation at Texas A&M and Karin Sinclair (NREL Avian Program Manager). Dr. Morrison is a recognized expert on wind-wildlife interactions, an advisor to NREL on that specific topic, and he has co-authored a widely accepted academic text entitled, *Wildlife Study Design*: Springer Press 2001. Dr. Smallwood has a Ph.D. in Ecology from University of California, Davis and serves as an Associate Editor for the Journal of Wildlife Management. The study design was first implemented in 1998 to conduct the initial NREL study. The same methods that were used during the CEC-funded study to provide continuity and comparability of the data collected with NREL funding. The APWRA studies included probably the most comprehensive and intensive fatality surveys conducted to date at a wind energy facility.

The cover letter also claims that their scientist revealed several analysis errors in the Smallwood and Thelander report. However, our responses show that in fact several errors were made in formulating Weisskopf's arguments. Therefore, her ensuing debate was based upon a flawed foundation. For example, Weisskopf transposed data, thereby incorrectly changing the mortality factor of golden eagles by a factor of three and used incorrect numbers to reach her allegation that Smallwood and Thelander made "significant errors" in their calculation of red-tailed hawk mortality.

Weisskopf also uses outlier data to portray the mortality estimates of a small bird species as inflated. The mortality estimates Weisskopf continue to focus on are merely estimates to better understand the magnitude of collisions and to compare between wind farm sites – these are based on standard protocol so comparisons can be more accurately determined. A large range in mortality estimates for small birds is an artifact of the standard correction factors (which we did not develop). Small birds (and bats) are easily missed by observers and scavenged more readily by predators. Additionally, the smaller the sample size, the more radically the adjustment factors will alter the magnitude of the estimate, resulting in increasingly larger ranges between the low and high adjusted mortality estimates. However, it is misleading to omit the facts that 1) actual numbers of fatalities (not mortality estimates) were used to determine associations of casual factors leading to higher collision risk and 2) the majority of the report focused on developing methods to reduce collisions for those larger bird species that had high enough sample sizes to do so.

High mortality in the Altamont Pass wind resource area has been documented since the facility first opened. The PIER report is based on several years of research unprecedented by any other avian-wind study. The underlying assumptions in the PIER-funded research are well-documented and follow standard protocol. The goal of the PIER-sponsored research was to identify an analytical framework to reduce bird kills in the Altamont Pass wind resource area and facilitate new energy development there and throughout the state. We believe the 2004 PIER-sponsored research accomplished that goal.

Response to California Wind Companies (CWC) Comments Received on the Assessment of Avian Mortality From Collisions and Electrocutions (Avian White Paper) August 30, 2005

WRITTEN COMMENTS

All comments are verbatim from the California Wind Companies (CWC) comment letter. The CWC also provided several attachments which are commented on separately

Responses provided by Commission staff and Dr. Smallwood lead author of *Developing Methods To Reduce Bird Mortality In The Altamont Pass Wind Resource Area.*

CWC-1: In addition to the documents that are made part of this proceeding, published PIER documents, analyses, assessments, technical memos or even verbal or written "opinions" relating to avian mortality issues (collectively "Staff Documents") have been publicly released without due process before this Commission. The Staff Documents, and the policies and recommendations they contain, have never been subjected to the high standard of "full and adequate participation by all interested groups and public at large. Such documents are gaining the force of CEC policy or rulemaking in the State of California, even though these publications have not undergone the rigors of scientific peer review, public review and comment, or formal adoption by the CEC itself."

Staff response: Staff strongly disagrees with the allegation that staff documents are being released prior to public and, particularly, industry review and argues that CWC's attachment of WEST, Inc.'s comments dated **July 2004** to their comment letter (CWC Attachment 7) directly conflicts with this allegation. Staff engaged the operators at the Altamont Pass WRA throughout the entire Altamont Pass Wind Resource Area (WRA) study. Staff, the WRA operators and U.S. Fish and Wildlife Service met regularly to discuss progress on the research. Staff provided the operators with monthly progress reports on the research, preliminary study conclusions and findings, and released a draft of the final Smallwood and Thelander 2004 report "Developing Methods to Reduce Bird Mortality in the Altamont Pass Wind Resource Area" ***only*** to the operators, California Department of Fish and Game, and U.S. Fish and Wildlife Service prior to soliciting public comment. Staff received only two comment letters by the operators (PowerWorks and Florida Power and Light) and one by their consultant (WEST, Inc.), and one verbal/email comment (SeaWest Power Resources, LLC). Staff also received two comment letters from California Department of Fish and Game. Staff's consultants responded to each comment and made changes to the document as appropriate (see attachment A). Staff also sent the draft final to three research scientists. The report prepared for NREL, which was based on the initial years of this study, was also subject to independent review by three scientists.

Therefore the opportunity for a "full and adequate review" of the Smallwood and Thelander 2004 report called for by CWC ***was in fact provided*** to the wind operators at Altamont Pass WRA prior to public peer review. Staff does not understand why the operators themselves did not provide any substantive comments at that time but instead chose to provide extensive comments a year after the report was released.

Regarding the other Staff Documents referred to (e.g. Smallwood and Spiegel 2005), these assessments were provided ***at the requests*** of the wind operators during meetings of the Altamont Pass Wind Working Group hosted by Alameda County: Commission staff and consultant were requested to participate on this group by the operators and the County. These meetings were held specifically to work out solutions between the operators and plaintiffs in a law suit against the operators to deter the law suit from going forward. The operators' consultant provided draft mitigation plans that the group was requested to review and provide comment. Smallwood and Spiegel provided assessments to these plans, as requested, using data from the 4-year research project that developed predictive analyses of potential risk to bird fatality from individual turbines in an attempt to lend sound science and rational behind the decisions for determining mitigation measures. These are released as staff comments and not published reports. The first assessment, "Assessment to Support an Adaptive Management Plan for the APWRA" was revised twice to accommodate additional analysis as requested by the operators to take into account turbine size rather than biological factors alone. The purpose of the revised assessments was to take into account non-biological factors and reduce the burden of implementing mitigation to certain turbine owners. Staff released these unpublished documents to the working group as requested and in the spirit of cooperation. Staff never intended to publish those working group assessments and questions why the CWC is now criticizing that cooperative effort, particularly given that the several mitigation plans provided to group for comment were not subjected to "full and adequate review" by anyone outside the group.

CWC-2: Statements by permitting authorities, stakeholders and law enforcement entities demonstrate that Staff Documents, and the recommendations contained within them, are defining the presumed impact of wind power generation activities on wildlife, and the measures that must be implemented to address those impacts:..

The comment then cites as examples: the 2004 IEPR Update; a comment letter by Commission staff to the Alameda County regarding proposed CUP renewals for wind turbines at the Altamont Pass Resource Area; a letter from the Commission's Executive Director clarifying that mitigation measures provided in the 2005 staff assessments are not official policy of the Commission, and; a letter from PIER and Siting Division managers offering comments to the most recent mitigation plan offered by the operators

Staff Response: Much of CWC's concern appears to be based on the fact the PIER reports are made public and that staff communicate with permitting agencies and make recommendations for permitting wind energy facilities. Given the Commission's responsibility for managing research projects addressing avian impacts from energy facilities and potential mitigation for such impacts, this communication is entirely appropriate. It is generally accepted practice for public agencies with expertise in a specific area to share that expertise with other agencies when addressing the same issues. PIER research is available to all public parties. If the operators disagree with the contents of that communication, the solution is for those entities to present their position and scientific research to the permitting agencies, etc., not to prohibit staff from presenting their recommendations and science.

Concerning the November 2003 letter from staff written to Alameda County regarding proposed CUP renewals for wind turbines at the APWRA, it is entirely appropriate for state agencies to comment on local agency CEQA-related matters. The fact that the letter requested a review of pertinent scientific research results directly related to the proposed action is also appropriate. Staff agrees that the letter, which ended by stating "The *Commission* looks forward to a continued cooperative relationship with Alameda County. [Emphasis added]", should have stated *Commission staff*.

Regarding the March 2004 letter from the Executive Director to Alameda County stating that the Executive Director wanted to make it clear that the recommendations in the staff assessments to the working group are not official policy of the CEC or it's staff and that specific permitting conditions are under the authority of the permitting agency, again we do not understand the point of the comment. In fact, given that the Executive Director of the Commission made it clear that the staff assessments provided to the working group do not represent official policy, we do not understand why the CWC is claiming otherwise.

Regarding the March 2004 letter from PIER and Siting Division managers to Alameda County which provided comments to the most recent mitigation proposal provided to the Alameda County Wind Working Group for review and comment, we do not understand why this is problematic. The letter was signed by the managers rather than staff due to earlier complaints by the industry to the Commission's Executive Director and Commissioners that staff alone was providing comments to the working group. While requested reviews of the mitigation plan to such a "working group" would not normally be signed by managers, this action was a direct response to these complaints in an effort to show that staff's managers concurred with staff.

In fact, the letters cited by CWC show that staff, managers and the Executive Director made extraordinary and repeated efforts to publicly and cooperatively participate in the process and to demonstrate Commission policy was not being imposed.

CWC-3: Other participants are obviously convinced that the California Energy Commission is responsible for publishing rules and recommendations relating to wind farm siting and operation…

In the above excerpt, the Petitioner's representative clearly implies that the California Energy Commission reports and recommendations should have been used by LADWP's consultant, even though the Petitioner never established that the PIER mitigation recommendations would be applicable to a site hundreds of miles away from the APWRA study location, and would apply at a site where certain songbirds, not raptors were of primary concern.

Staff Response: The fact that the Center for Biological Diversity and a Kerncrest Audubon Society member referred to the Commission's Smallwood and Thelander 2004 consultant report does not imply that they are convinced that the Commission is responsible for publishing rules and recommendations relating to wind farm siting and operation. However, it is quite common to site public reports that are directly related to a specific issue.

Regarding the incomplete transcript of the discussions between Kerncrest Audubon Society and LADWP that is provided, the Audubon representative is simply asking the LADWP consultant if the Smallwood and Thelander 2004 report was consulted for mitigating against avian mortality, especially raptors. CWC complains that songbirds, not raptors, were of primary concern. The Smallwood and Thelander 2004 report is specific to the Altamont Pass and explicitly states this in the document and in the title itself. It is also explicitly stated in the report that mitigation is directed toward reducing impacts to raptors in the Altamont Pass and not songbirds or any birds anywhere else. We can not be responsible for any misuse of the information by anyone.

CWC-4: In its July 6 2005 letter to Alameda County Board of Supervisors, written just prior to the Board's July 7 consideration of the permits for the APWRA wind projects, the AG confirmed that it is relying primarily on CEC documents, and on discussions with CEC staff and consultants, to support the very forceful recommendations it made to wind energy site permitting authority.

Staff Response: It is entirely appropriate for state agencies to rely on other state agencies for expertise. It is our understanding that the State Attorney Generals Office read every document available on this issue, including the mitigation plans provided by the operators, met twice with the Altamont Wind Operators to gain their input and came to their own conclusion.

CWC-5: The EPR states, "Statewide guidelines for wind energy projects may be an appropriate way to gain consistency statewide when developing and mitigating projects. Statewide standards could also remove a significant environmental barrier to increasing wind energy in the state." This statement can be seen as an attempt to erode the authority of the Counties, and thus deserves a full and adequate review by the public, including all affected permitting authorities, before becoming Commission policy.

Staff Response: Statewide guidelines to site and monitor new wind developments would in fact be a way to gain consistency when developing projects. Currently, siting wind developments at the local level is inconsistent, as is monitoring the effects of developments. Therefore, it is difficult for all stakeholders, including the wind industry, to effectively plan, comment, and fully understand the statewide impacts of proposed and constructed wind developments. Such guidelines are available in other states such as Washington. This proposed effort is in no way an attempt to erode the authority of Counties, but rather would provide a useful tool for Counties to use while siting new developments. Guidelines for siting various developments are common and generally useful to permitting agencies, particularly those unfamiliar due to lack of experience with certain types of developments. Wind development is expected to rapidly expand in California and many Counties that have not experienced wind development in the past would greatly benefit from a guideline document.

CWC's comment that this recommendation deserves a full and adequate review by the public, including all affected permitting authorities, before becoming Commission policy is puzzling. The purpose of releasing the staff report on avian mortality, the public workshop, and the process of soliciting public comment is exactly what has occurred to solicit full and adequate public review. The fact that CWC has provided comments on this report shows that CWC has in fact had the opportunity it requested.

CWC-6: An example of the hazards of the Commission's failure to allow full and adequate public participation and scientific review can be found in the CEC Staff Avian Report regarding bat mortality in Solano County. Monitoring results found therein are reported out of context and without reference to the protocols being used. The CEC Staff Avian Report also fails to mention that the results are not unreasonably high for the western United States according to a review of the survey data. However the CEC staff Avian Report immediately jumps to the conclusion that "[m]itigation could include a seasonal shutdown and removal of the highest risk turbines as needed to reduce this impact."

Staff Response: Surveys for bat fatalities at wind facilities other than High Winds has not been conducted in California and bat fatalities at the High Winds project is notably high thus spawning concern for other wind resource areas. Staff readily reports that "Surveyors may not have observed bat carcasses because of large time lags (up to 90 days) between survey dates…more recently, bat fatalities have become an issue at some wind farms including at the Solano County WRA where surveys for bats have been conducted." (page 15). Staff also states "the frequent search periods [in Solano County] may contribute to finding the bats before they are scavenged" (page 22). Staff believes that this new information - that bat fatality by wind turbines may also be a concern in California – illustrates a need to further investigate and better understand the extent of the problem. Most bat species in California are species of special concern and taking proactive steps to avert further fatalities is warranted. The suggestion to possibly implement seasonal shutdown and removal of high risk turbines was not a conclusion as stated by CWC and merely a potential mitigation effort if it is found that bat fatalities are shown to be unacceptable.

CWC-7: Unsuccessful Efforts to Participate in the Development of CEC Avian Policy. Since 2002, The CWC have asked PIER staff and its consultants for specific information relating CEC Staff Documents. Scientists working for the CWC have made numerous data requests and posed several technical questions to the PIER staff and consultants prior to and after the PIER August 2004 Report was published. The purpose for these inquiries was to support the development of the Altamont Adaptive Mitigation Plan, (AMP WEST 2005). The primary objective of the AMP is to significantly reduce avian mortality at the APWRA.

Many of these data requests were initially denied, while some were eventually honored. For example, WEST scientists have still not received risk modeling results of turbines that were not characterized during the PIER study; identification of the high-risk turbines in the latest PIER report; and a complete data set necessary to determine specific baseline fatality rates and the associated uncertainty.

We have not, for the most part received specific nor timely answers for PIER in response to our requests. In response, only successive written reports and assessments, each containing new conclusions an recommendations were issued outside of a formal protocol. If the PIER staff continues to circumvent public participation, it will be difficult to verify the accomplishment of their stated goal of reducing avian impacts “with the least cost to wind industry”.

Staff Response: Staff strongly disagrees with this comment and is completely astonished by the suggestion that staff avoided full engagement with the industry throughout the entire process. Contrary to the CWC comment, since September 2002 staff met regularly with the Altamont Pass Wind operators and U.S. Fish and Wildlife Service at the Fish and Wildlife Service Office in Sacramento to discuss the project, keep the operators informed, provide monthly progress reports, and provide preliminary findings (see staff response to CWC-1). In fact, staff’s consultants were very hesitant to provide preliminary findings because they were based on incomplete studies but did so to show good faith and at the insistence of the operators. However, by doing so, we have been accused of changing the results despite repeated disclaimers that the results will likely change once the complete data set is analyzed.

Direct evidence against this CWC comment can be found in the statement of M Joan Stewart on behalf of FPL Energy on file with Superior Court, Case 183113, and available as public record. Dated **July 27, 2005** in the following case:

Case No. RG 04 183113, DECLARATION OF M. JOAN STEWART IN SUPPORT OF THE FPL DEFENDANTS’ MOTION TO DISMISS AND/OR STAY ACTION UNDER THE ABSTENTION DOCTRINE**.** CENTER FOR BIOLOGICAL DIVERSITY, INC., et al., Plaintiffs, v. FPL GROUP, INC., et al., Defendants

In her declaration she states in Item 11 (Page 4) [Emphasis added]:

“For the past **five or so years** I have been actively involved in an ongoing, **collaborative effort** to mitigate the avian impact of FPLE’s wind turbine operations with APWRA. As noted in the report from the Alameda County Planning Department document attached hereto as Exhibit A; “The operators of existing projects are working with the USFWS, **CEC** and County to see methods to reduce avian impacts, including cooperation with on-going avian studies of avian impacts and potential mitigation strategies.” See Exhi. A herto at Page 5).”

In Item 12 of her statement she declares:

“All parties involved, including FPLE, have invested considerable time and money in this collaborative process. For example, both NREL and CEC have funded detailed studies by an environmental consulting firm. At a meeting I attended on April 10, 2003 with the USFWS, a representative of CEC reported that CEC had spent or is planning to spend $1.5 million, much of it directed to APWRA.”

In Item 12 of her statement she declares: “In conjunction with this effort, FPLE has worked with the following government entities:

a. US Fish and Wildlife Service
b. US Dept of Energy, National Renewable Energy Laboratory
c. California Energy Commission
d. Alameda County Planning Department

e. California Department of Fish and Game

The claim that PIER staff has not complied or ignored CWC scientist's data requests is undeniably false. The CWC's scientists have been provided with every data request submitted, including the CEC data files, and three additional assessments to identify the high risk turbines. (See also the email exchange between Smallwood and WEST – Attachment to Staff Response to CWC Attachment 7)

Regarding the comment "Many of these data requests were initially denied, while some were eventually honored", staff would like to know what requests were never honored. The only data requests denied were those for NREL data, not CEC data, which staff has repeatedly told the CWC's that only NREL can release it's data. All other data requests were provided, and in staff's view given the breadth of the 4-year data set, in a very timely matter. On the other hand, many promises by the CWC's employees and consultants to provide data sets useful to our analysis were never honored or honored several years after the request. These include: maps of the APWRA, physical attributes of turbines results of studies on rodent control, results of studies directed toward the effectiveness of perch guards and blade painting schemes, and yearly reports to Fish and Wildlife Service.

Regarding the comment by CWC that in response to their data requests they have only received successive written reports and assessments, each containing new conclusions and recommendations that were issued outside of a formal protocol, staff reiterates earlier comments that **these modified assessments were requested by the industry to the Alameda County Working Group using criteria requested by the industry**. Therefore, it is puzzling that CWC now claims that receiving these assessments were unexpected. Using different criteria as requested by the operators would obviously yield new conclusions. Staff was inclined to use the results from the first assessment, which was based solely on biological data, but staff refined this assessment to include turbine size to accommodate operators' requests to provide a more equitable outcome. The fact that these additional assessments of the PIER data set were not PEER reviewed is correct; however, these assessments were provided to a working group at the request of that working group and not as published reports. The mitigation plans developed by the wind operator's consultants that these assessments were responding to were also not PEER reviewed, and we did not expect them to be. All documents submitted to the working group, including staff assessments, were done in a cooperative format to resolve issues.

CWC-8: Improving CEC Procedures. The Commission should insist that all staff clearly distinguish policy recommendations from scientific research and publications, and distinguish Commission-adopted policy from staff positions.

Staff Response: Staff has clearly distinguished policy recommendations from scientific research and publications and has distinguished Commission-adopted policy from staff positions. This has been made evidentially clear by the disclaimer in the front of the 2004 consultant's report and in the letter provided to Alameda County by the Executive Director and by staff (see staff response to comment CWC-2).

The 2004 CEC Pier-sponsored consultant report by Smallwood and Thelander came with the disclaimer that “This report was prepared as a result of work sponsored by the California Energy Commission. It does not necessarily represent the views of the Energy Commission, its employees or the State of California. The Energy Commission, its employees, contractors or subcontractors make no warrant, express or implied, and assume no legal liability for the information in this report, nor does any party represent that the uses of this information will not infringe upon privately owned rights. This report has not been approved by the California Energy Commission nor has the California Energy Commission passed upon the accuracy or adequacy of the information in this report.”(see CWC Attachment 1)

A March 2004 letter from the Executive Director to Alameda County clearly stated that the recommendations in the staff assessments to the working group are not official policy of the CEC or it’s staff (see CWC Attachment 3).

Because both of the references above were attachments to your comment letter, is it unclear why you would claim that the Commission does not distinguish policy recommendations from scientific research and publications, and distinguish Commission-adopted policy from staff positions.

CWC-9: Conclusions and Recommendations. We recommend that the Commission adopt the following principles as part of the IEPR polices:

9-1: Wind generation is a critical element of California’s renewable energy, economic, and climate change polices and any Commission recommended avian measures must consider the impact on generation.

Staff Response: Staff concurs that wind and other renewable resources are important and necessary components of California’s energy mix which is why PIER research focused on resolving ongoing impacts to biological resources from wind energy developments, particularly in the Altamont Pass WRA where bird fatalities are and have been unacceptably high since its existence and no resolution to these impacts were in sight. Staff assessments by Smallwood and Spiegel 2005 used impacts to both biological and generation criteria to determine mitigation measures. Staff acknowledges that there could be a relatively minor loss of generation (during winter months if the industry plan is implemented); although wind expansion could also increase as avian impacts are addressed.

9-2: The APRWA is a unique wind and open land resource that may require unique mitigation measures due to the pioneering generation technology that exists today, the large numbers of migratory birds who utilize that area and the special terrain. Thus avian mortality reduction measures applicable in the APRWA are not directly transferable to any other wind resource area in California without further scientific analysis;

Staff Response: Staff agrees and states so in every document provided to date. Indeed the title of our PIER report is “”Developing Methods to Reduce Bird Mortality in the **Altamont Pass Wind Resource Area**”. Staff was not involved in designing mitigation for the Solano wind farm. The Avian White paper simple pointed out that measures designed for Altamont were implemented in Solano and should be monitored. (page 22).

9-3: Through a collaborative process with all stakeholders, the Commission will establish and adopt peer and public review process for any scientific research in the PIER program, performed on the environmental impacts of wind generation in California. No staff report may be issued or released under the CEC name until these new processes are followed -- including Commission approval where appropriate;

Staff Response: Staff did engage all stakeholders in a review process. In fact, the comments received by CWC for both the Smallwood and Thelander 2004 and EPR Avian report demonstrate that this occurred. Staff is completely perplexed as to why the CWC claims otherwise.

9-4: New wind turbine technology, including repowering of California's pioneer technology fleet, currently appears to represent a primary means of reducing wildlife impacts;

Staff Response: The PIER consultant report, Smallwood and Thelander 2004, concluded that repowering the Altamont Pass Wind Resource Area would significantly reduce the incidence of bird strikes with turbine blades because of existing bird flight patterns observed in the APWRA during the study. It is noteworthy that this conclusion was not challenged by CWC despite the fact that it was derived from the same scientific study that CWC challenges on other fronts. The PIER report also states that this conclusion is specific to the Altamont Pass WRA because it specially relates to bird flight behavior at that site and does not suggest that this is applicable to other sites. In fact, the industry complained about extrapolating the findings of the APWRA study to other sites (CWC-3), and should themselves be more consistent in their recommendations.

The 2004-PIER sponsored report explicitly states that all recommended mitigation measures, including repowering with taller turbines, should be monitored before conclusively determining that the measure will result in a reduction to bird fatalities.

9-5: Energy production and economics experts within CEC should be allowed to collaborate on environmental research when appropriate and necessary to fulfill CEC goals of reducing avian fatalities while fostering the production of wind energy at the least cost to the wind industry;

Staff Response: PIER staff from the environmental area consult with PIER staff from renewables and PIER’s economic consultant. An analysis of the economic impacts can not be completed by PIER staff because the information needed do to so will not be provided by the CWC.

9-6: Economic issues associated with the avian impacts due to the operation of new generation turbines, with its significant capital investment, require appropriate pricing policies by the CPUC; and

Staff Response: No response.

9-7: Full public access to all data and information behind publicly funded research by the CEC staff, including the Staff Documents. This would include the immediate release of the **APWRA** data underlying the August 2004 PIER Report.

Staff Response: Full public access to all CEC data and information behind the PIER 2004 research report has been provided. Staff has also provided additional analyses requested by CWC at no cost to the CWC, so this comment is both unfounded and puzzling to staff.

Attachment A

Written comments and consultant responses to Industry and Agency review of the Draft-Final PIER 2004 Report, *Developing Methods to Reduce Bird Mortality in the Altamont Pass Wind Resource Area*.

Reviews from:
Rick Koebbe, PowerWorks
Joan Steward, Florida Power and Light
Steve Steinhour, SeaWest Wind Power
Ron Jurek, California Department of Fish and Game
Sarah Calzada, California Department of Fish and Game

Response From PowerWorks (Altamont Winds Inc./WindWorks Inc.)

Dear Linda,

Thank you for posting the report "Developing Methods to Reduce Bird Mortality in the Altamont Pass Wind Resource Area" by BioResource Consultants and the California Energy Commission (Final Report, PIER-EA Contract No. 500-01-019, undated) on your website for our review. Pursuant to your request to receive comments by 30 June 2004 (or shortly thereafter), please find some comments below based upon our preliminary review of the report:

1. Environmental benefits. Without diminishing the seriousness of avian impacts in the APWRA, we suggest that the report mention the substantial environmental benefits that result from the Altamont Pass wind farms generating electrical power as compared to other, conventional energy resources (i.e., fossil fuels). For example, the Altamont Pass wind farms provide the following environmental benefits:

we estimate that the Altamont Pass produces an average of about 1.1 billion kwh per year, therefore, the pollution savings from an equivalent gas-fired project would be approximately:
CO2 savings = 1,200,000,000 lbs/yr
reduced natural gas consumption savings = 3,800,000,000 cf/yr
water consumption savings = 282,000,000 gallons/yr
As you can see, these environmental benefits numbers are staggering (not to mention the local economic benefits to the Altamont Pass area, estimated to be over $1 billion over 20 years).

as mitigation to a gas-fired project, the Altamont Pass wind farms offer the following:
equivalent amount of trees planted to consume CO2 = 46,000,000 trees
equivalent forest planted = 310 square miles

or, Altamont Pass wind farms result in the reduced use of other fossil fuels, equating to approximately:
oil consumption savings = 660,000 barrels/yr
coal consumption & mining savings = 153,000 tons/yr

Air pollutants and green house gas emissions are avoided when power is produced from wind--which makes a healthier environment for both humans and animals, including birds (perhaps, a good future study topic for the CEC--how many birds and other animals are we saving?).

Altamont Pass wind farms also keep the APWRA an agricultural zone, free from urban development which would otherwise eliminate habitat for many species, which likely prevents substantial environmental impacts. You have probably seen the housing developments that are building ever closer and closer to Altamont Pass.

We strongly encourage you to provide some necessary balance in your report, especially considering that the Schwarzenegger Administration greatly promotes renewables, including wind power, in California.

Response: Our purpose was to understand the factors related to bird collisions in the APWRA, and to recommend measures to reduce mortality. It was not to compare the environmental costs and benefits of wind power generation versus other modes of electrical power generation. We agree that such comparisons should be made, and we would be happy to make the comparisons ourselves, but not in this report. Our report is not intended to advocate for or against wind power.

2. Chapter 9, Recommendations. The report recommends certain mitigation measures to be implemented that, based on the study data, analysis and conclusions, may help alleviate bird mortality in the APWRA. While all ideas should be initially considered, we feel that, had input from the APWRA wind industry on the practicality of these recommendations been solicited prior to issuance of the report, the following measures would not have been included as recommendations (impractical for technical, logistics, schedule and/or economic reasons). (Note: item numbers correspond to those in Chapter 9, Section 9-1.0 of the report.)

Response: That is what this review is intended to do – to solicit input from the industry.

- **No. 3d. Rely on wind turbines that do not require concrete pads.** From an engineering standpoint, all wind turbines require concrete foundations of some sort. (Replace the term "platforms" used in the report with "concrete pads" or "foundations," as this terminology is incorrect and confusing.)

Response: Done. Change made.

- **No. 9. Replace gaps in wind turbine strings with turbines moved from other, more dangerous locations.** It seems this would then create the same undesirable gaps in the strings of the more dangerous turbine locations where the turbines were relocated from. Perhaps this should be clarified.

Response: Good point. Clarification was added.

- **No. 9 Coordinate the operations of turbines in a string as either all on or all off.** The report correctly points out localized wind speed variations would make this difficult, but other barriers also exist: different turbine types (with different operating characteristics) co-exist in some strings, turbines in some strings are not operated by the same companies, individual turbines periodically go out of service for technical problems (and during the night, they cannot be worked on and returned to service), and daily maintenance needs to be done on individual turbines requiring them to be temporarily out of service.

Response: Understood. However, it might be helpful to operate all the wind turbines in a string at the same times. At least these turbines are owned by the same owner and are experiencing more or less similar wind conditions at any given time. We propose this measure as one to consider, and we do not expect implementation beyond what is feasible.

- **No. 11 Install "busy" wind turbine designs that differ from conventional horizontal- and vertical-axis designs.** We are not aware of any commercially available turbines that fit this description, and no wind project can be financed or permitted without using commercial-scale turbines that have already been fully tested and certified to international standards.

Response: Understood. However, perhaps new designs could be developed that achieve the business on the landscape that we advocate, or other ideas could be pursued to achieve the same end result. We are not proposing that turbine designs matching those in the photos be installed.

- **No. 12 Install accelerometers to collect data on the times of day birds strike turbine blades.** This would be quite an engineering challenge. Assuming the technology could be developed, retrofitting a substantial number of turbines in order to get a sufficient study sample size, and collecting data for a sufficient time (the report states a minimum of three years for any valid field experimentation) would be a significant undertaking without knowing that any useful data would result from this exercise (and this measure in and of itself will not reduce avian collisions).

Response: We agree. It might not be feasible to install accelerometers on the existing wind turbines. However, it may be practical to do so on wind turbines installed as part of the repowering of the APWRA.

3. Chapter 9, Recommendations. We also have some questions that we would request you consider to be addressed or clarified in your report concerning your recommendations. (Note: item numbers correspond to those in Chapter 9, Section 9-1.0 of the report.)

- No. 3a. Re-contour lay-down areas and access roads to reduce vertical edges. Wouldn't this be potentially counter productive since the re-contouring operation will increase non-vegetated areas (at least temporarily) and conflict with the recommendation to allow the grass to grow taller around the turbines?

Response: The effect on the vegetation would be temporary, as noted in the comment.

- **No. 3b. Move rock piles.** For us to better determine the practicality of this recommended measure, please define rock piles (size, for example) and how far away from turbines they should be moved.

Response: See Photo 9-2 on page 326. Rock piles should be moved maximally distant between turbine strings, or down the slopes near to the bottoms of drainages.

- No. 3c. Exclude cattle from around turbines. The report recommends excluding cattle from around turbines and allowing the grass to grow taller. Is it possible that the taller grass might actually attract more small mammals and therefore, the raptors that prey on them?

Response: Yes, which is why we recommended that this measure be implemented experimentally, and in the second tier of priority.

- Additional concept--acoustic deterrents. We note that the report makes no mention of acoustic devices to deter birds from flying near turbines. Is there a reason why this concept was not recommended (potential non-effectiveness, lack of technology, just overlooked)? We have seen somewhere that a technology exists whereby you install high frequency sounds devices to detour birds, however, does it work?

Response: We do not know whether such an acoustic device would work, and we have no experience with these in the APWRA. For these reasons, we did not make any recommendations about acoustic devices. As an additional note, we do not believe such a device will be effective, only because the wind turbines in the APWRA are already loud enough to be heard easily. These is nothing like the swoosh of a blade to get your attention when you are near a wind turbine.

4. Chapter 9, Priorities of recommended measures. We feel it would be helpful to better understand why certain recommended mitigation measures have been selected as (1) priority vs. (2) priority. Please clarify.

Response: We have greater confidence in the effectiveness of the measure sin priority group 1 as opposed to priority group 2.

5. Avian mortality estimates, Table 3-11 & 3-12. We feel the report should provide an explanation as to why the low values and high values of the mortality uncertainty range are regarded as the data adjusted for search detection and the data adjusted for search detection and scavenging, respectively.

Response: There could have been numerous ways to establish low and high bounds of a mortality estimate, and it really comes down to investigator judgment of what is the most reliable way to do this. Given the inherently high variability in the estimates derived from many wind turbines that were searched for short durations, an arbitrary, constrained decision on how to define the low and high bounds of the estimates seemed more reliable than using error statistics such as standard deviation, two standard deviations, variance, or any other statistical term, the choice of which, by the way, is just as arbitrary as our chosen method.

Finally, it would be ideal if we had more time to review your draft study--a study of this magnitude, with potentially significant consequences to wind power in Altamont Pass, needs adequate technical review by our consultants and possibly others to review the methodology utilized by Mr. Smallwood--it cannot be done in 2 weeks. Therefore, we strongly encourage you to consider allowing more time to better understand and digest the voluminous amount of information.

Thank you for the opportunity to comment on the report.

Please contact us if you have any questions.

Best regards,

Rick Koebbe
Altamont Winds Inc.
WindWorks Inc.
Boise, Idaho
phone 208.853.4602
www.powerworksinc.com

Response from FPL

The following are comments and recommended edits from a preliminary review of the draft final report, Developing Methods to Reduce Bird Mortality in the Altamont Pass Wind Resource Area.

General –

There is confusion in the names of wind turbine components. There are typically two types of foundations; piers are most often used for the lattice towers, although in some cases because of soil conditions "pad" or spread-footing foundations are used. For most if not all tubular towers a pad footing is used. It might be better to use the term "base" to refer to the location where the tower meets the ground in your discussions of elevation.

Reply: The report was revised accordingly.

The Kenetech turbines have a work "platform" at the top of the tower, under the nacelle. Several tubular tower styles also have work platforms at turbine height. The nacelle is the fiberglass/plastic housing that surrounds the turbine (see page 332).

Reply: The report was revised accordingly.

Specific –

Page ii, paragraph 5, line 9 – Change "Altamont Wind Power" to "Altamont Power".

Reply: The report was revised accordingly.

Page xxviii, Report Organization, line 4 - change the word "distribute" to "collect".

Reply: The report was revised accordingly.

Page 43, paragraph 4, line 3 – What were the physical criteria for determining "probable cause of death"?

Reply: See last paragraph of page 43.

Page 72, paragraph 4 – It would be helpful to have this spreadsheet included as a table.

Reply: Probably true. We will attempt to insert this table if time permits.

Page 107, paragraph 3, line 1 – It would be helpful to include an area map showing the location of the 70 strings of turbines within the WRA included in the individual maps that follow.

Reply: We will attempt to include if time permits, but we are not convinced that this map will help.

Page 107, paragraph 4 – Alameda County Agriculture Department administers the program. For several years AIC coordinated activities on properties where Kenetech turbines were located. We shared the cost with the landowner/tenant if they allowed the County to apply the treatment. If the landowner or tenant wanted to continue their own application we paid to have the County inspect the application to assure application consistency for the study. In addition we hired personnel to survey using the following schedule.

Reply: Alameda County told us that the wind companies maintained a data base on the program and how and where it was applied.

Monday:	*1st day of poison application*
Tuesday:	
Wednesday:	*2nd day of poison application*
Thursday:	**First day of GS carcass surveys**
Friday:	*3rd day of poison application*
	Second day of GS carcass surveys
Saturday:	**Third day of GS carcass surveys**
Sunday:	**Fourth day of GS carcass surveys**
Monday:	**Fifth day of GS carcass surveys**
Tuesday:	**Sixth day of GS carcass surveys**
Wednesday:	**Seventh day of GS carcass surveys**
	Continue until no additional carcasses are found

Page 109, Photo 6-4 and elsewhere – The photo shows and the text refers to, not a pipeline, but a firebreak. Firebreaks are created, typically in April or May of each year. We are not aware of the practice in the Altamont of disking soil over pipelines.

Reply: We observed a pipeline constructed in the APWRA and then regularly disked. Nevertheless, we changed the text.

Page 120, paragraph 1, line 3 – The reference in the text and the location of string 8 in Figure 6 don't match. Change "Vieux" to "City of Santa Clara" in the text.

Reply: We do not believe this comment is true. We would like more evidence that the change is needed before we make it.

Page 179, last paragraph – To my knowledge the recommendation for rock piles came from Sue Orloff with BioSystems Analysis, Inc. in the early 1980's, as part of pre-construction survey reports and not as a requirement from the FWS.

Reply: Change made.

Page 238 paragraph 2, line 4 – It is not economically reasonable or a "cost effective approach" (see page xxx) to construct new 140 foot lattice towers to create wind wall configurations to move existing turbines.

Reply: And we never suggested that this be done. We believe the comment provider misread the report.

Page 242, paragraph 4 – It would be extremely useful to include a map with all the observation plots including observation points marked so that subsequent researchers could gather comparable information in future studies.

Reply: We have this information in hard copy form, and will attempt to get it digitized and inserted into the report, time permitting.

Page 249, paragraph 4, line 3 and elsewhere – Diphacinone was last used by Alameda County in 1997. Since that time the County Ag. Department has used Chlorophacinone.

Reply: Jim Smith at Alameda County told us the opposite sequence.

Page 367, paragraph 3 – There is apparently confusion on the part of the author. The only turbines included in the study and the report were Kenetech turbines.

Reply: True enough. The identified paragraph was removed.

Joan Stewart
July 8, 2004

SeaWest Response

-----Original Message-----
From: SSteinhour@seawestwindpower.com
[mailto:SSteinhour@seawestwindpower.com]
Sent: Friday, July 02, 2004 9:59 AM
To: Lspiegel@energy.state.ca.us
Subject: RE: proposed sentence change

Linda...Thanks for checking with Carl and Shawn as to intent of sentence.
This amendment to clarify that intent reads more clearly. OK with me.
Regards, Steve Steinhour

-----Original Message-----
From: Linda Spiegel [mailto:Lspiegel@energy.state.ca.us]
Sent: Thursday, July 01, 2004 1:08 PM
To: SSteinhour@seawestwindpower.com
Subject: proposed sentence change

Nevertheless, for other species, such as golden eagle, red-tailed hawk, and American kestrel, if shutting down turbines was the only management treatment considered (but we recommend multiple treatments, see Chapter 9), it would be necessary to remove most or all of the currently operating wind turbines for mortality to substantially lessen.

CEC report comments Ron Jurek, CDFG, June 29, 2004

Linda,

I agree with the many recommendations for reducing the attaction of birds to wind machines and adjacent sites. If the assumption is that the area is responsible for mortality in excess of it's value as breeding and foraging habitat for vulnerable species, the logical response is to reduce the attraction of those areas to birds (reduce the number of birds attracted to the area and reduce the time they stay) and reduce the rate of mortality of those that use the area.

Some of the other comments I offer deal with what is not in the report.
I feel they are matters that would important to address for evaluating impacts and for recommending corrective actions.

Page 6 - Although the importance of environmental factors is mentioned on page 6, there is no discussion of environmental conditions at time of collision. The recently injured birds, and possibly truely "recently dead" birds, provide an opportunity to document such conditions during the previous night or day (e.g., information about nightime conditions of moonlight, fog, wind; daytime conditions of wind direction and strength, and to obtain other useful data, such as estimates of time and date of collision.

Response: We cannot estimate the time of collision, but we did estimate date. We would have to have a different monitoring approach in order to get the resolution of time of death so that weather conditions could be recorded and analyzed.

Page 47 - Authors referred to results of previous scavenger research but modified a calculation factor for this study based on "belief." The reason for that change may be justified, but that justification should be given. Also, was relative scavenger abundance during this study equivalent to time periods or areas used for comparision or used for methods?

Response: In fact, we did give the justification for our belief. It was based on our experience in the APWRA. We could not understand the concluding question.

Page 71 - I feel there should be some account of the significance of the deaths of 89 burrowing owls (e.g., are these migratory or resident birds; how does this total relate to the size of the resident population in the area?)

Response: We don't know.

Page 337 - There is only brief mention of the possibility of nighttime hazards, and only then with respect to a need for further research. If this recommendation is based observations obtained during the current study or on prior research, there should be some explanation why this point was mentioned.

Response: We thought we made it clear why we mentioned the need for additional research on time of day of collisions – because we don't know anything about the role of time of day. We don't have any information on it because our sampling program did not result in data at this resolution. A cost-effective method is needed, which we recommended.

Based on the many years of research on raptors at Altamont, has anyone determined whether raptors perch on blades at night? If so, is that a concern?

Response: We can think of no safer place for raptors to perch than on the blades. The raptors would know when the blades start moving, and would simply fly off.

It would be important to knows the magnitude of nighttime perching on blades. What is the behavior of blade-perching diurnal species of birds at night when wind increases and blades spin? If raptors perched on blades on still, moonless nights are forced to fly when night wind picks up, are such flying birds especially vulnerable to flying into now spinning blades?

Response: Nighttime flights made by diurnal birds might indeed get them killed more often by wind turbines. We don't know how often collisions occur at night.

Is there a need to make modifications to reduce nighttime collisions, such as moving blades at in evenings to keep birds from using them as night perches.

Response: Perching on blades during the night will be no more hazardous than perching on work platforms or anywhere else on the towers during night, unless one suspects that birds perched on blades are more apt to be forced to fly as the wind picks up. But it won't be the blades perched on that kills the bird, it will be some other moving blades (unless the birds circles back to the same turbine it was perched on, and which is now operating).

As a side note, here is a web site with information about the threat of wind machines to birds over water: http://www.ifv.terramare.de/offshore/Exo_et_al_WSGBull100.pdf "The greatest collision risk occurs at night, especially on moonless nights or in unfavourable weather conditions such as fog, rain, and strong wind. These conditions also tend to reduce the flight altitudes of migrating birds. Radar studies of behavioural responses to turbines on Lake Ijsselmeer, The Netherlands, indicate that some ducks will fly between turbines in moonlight, but around the outside of turbine clusters in conditions of poor visibility. This suggests that some, probably local, birds can adjust their behaviour to the presence of turbines (Spaans et al. 1998). Nevertheless behavioural observations have shown that most birds fly closer to rotor blades at night than during the day and that more birds collide with them at night than by day (Winkelman 1990)."

Response: We are familiar with Winkelman's study and his conclusions.

Page 209 mourning dove is spelled wrong.

Response: Change made.

Other remarks

I found no mention of the significance of other factors that might cause birds to blindly fly into blades:

Startle response - Perched bird startled by disturbance may fly into blades or wires. Human activity at such critical times might be a concern.

Response: See pages 246 and 262.

Lights - I found no mention in the report of lights or lighting in the study area. What is the extent of lighting in the wind farm? Are birds, particularly burrowing owls, attracted to insects around lights?

Response: We don't know.

I understand that situation presented a collision problem for burrowing owls at the prison in Calipatria, where owls flew into electric fences at night. I don't have a reference for that, but Joe Vincenty in our office dealt with that issue.

Poor visibility of blades - I found no reference in the report to the phenomenon of collisions possibly resulting from birds flying towards the sun and striking blades or wires. Perhaps there is a need to make spinning blades more visible or otherwise detectable when backlit from the perspective of a bird in flight.

Response: We did discuss blade visibility.

Bird bands?

There was no mention of whether any bird carcasses found during the four years had bird bands. Instances should be described; otherwise, some statement should be made that bands were not searched for, or were searched for an none were found.

Response: Finding and reporting bird bands was not the purpose of our study, but we can go through our records and locate these instances, which were recorded. Time permitting, we will include some information on bird bands.

I hope these comments will be helpful. Thanks for giving me the opportunity to review the draft document.

Regards,
Ron

Ron Jurek

CEC report comments Sarah Calzada, CDFG, June 30, 2004

Linda,
I agree with most of the recommendations to reduce bird mortality in the Altamont Pass area. However, I have a few other comments/suggestions concerning the recommended mitigation measures that are not clear in the draft report.

- pg. 323, No. 1 I agree that the WRRS should be replaced with a trained biological monitor and that there should be monitoring for each recommended mitigation measure. This section also mentions that the monitoring reports should be regularly published, but does not define the term "regularly". Please specify whether the reporting required would be monthly, quarterly, or other.

Response: This is a level of detail we don't want to get into in this report.

-pg. 324, No. 3 I agree with altering habitat to reduce raptor foraging near the wind turbines, but have some concerns regarding the habitat alteration. It is recommended that cattle be excluded from around wind turbines and that rock piles be moved, both within 50 m from the wind turbines. What is the 50 m for both the cattle fencing and moving rock piles based on? Is there a specific study that is being referred to?

Response: Yes, see the Behavior Chapter that addresses proportions of flights of raptors within 50 m, 51 to 100 m, and 101 to 301 m from wind turbines.

In regards to the fencing of the cattle what type of fencing will be used and what will be done to discourage birds from using the fencing as perching areas?

Response: We did not suggest a type of fencing, and we do not know what might be done to discourage birds from perching on the fence. This may not even be a good idea. Perhaps disking the areas near wind turbines is a better idea.

- pg. 336, No. 6 Alternative Perches states that it is not believed that "alternative perches would substantially attract perching birds away from the thousands of perches available already", but does not mention why this is believed. Please explain in more detail.

Response: The very sentence quoted explains why we believe this. Thousands of perches are there already. Why would a bird decide to perch on the alternative perches we install out there when the thousands of perches already there are already available?

- pg. 337, No. 10 Relocate selected wind turbines- Wind turbines that cause the highest bird impacts should be relocated first. Also, if any of the wind turbines are placed in areas that are frequently used by birds, such as migration corridors, they should be relocated as well.

Response: We agree, and this prioritization is exactly what we propose.

- pg. 338, No.16 Acquire offsite conservation easements- I agree that conservation easements can be used for compensatory mitigation, however the area set aside for easement should be equally comparable to the best foraging area within Altamont Pass and the area with the most impacts.

Response: We agree.

-Has there been any research done on noise regarding impacts on birds and possibly deterring them away from the wind turbines? This can probably be added to the experiments with future turbine design. I didn't see anything related to the birds and how they react to the noise when the turbines are running. Would it be possible to make them louder or install a type of sound alarm as a warning?

Response: The wind turbines already make a lot of noise. Additional research could be performed in this area, but we did not do that.

Thank you for giving me the opportunity to comment on the draft report.
-Sarah Calzada

Attachment B

References

References Used in Staff Responses

Anderson, R., N. Neumann, J. Tom, W. P. Erickson, M. D. Strickland, M. Bourassa, K. J. Bay, K. J. Sernka. 2004. Avian Monitoring and Risk Assessment at the Tehachapi Pass Wind Resource Area; Period of Performance: October 2, 1996--May 27, 1998. 102 pp.; NREL Report No. SR-500-36416.

Anderson, R., W. Erickson, D. Strickland, M. Bourassa, K. J. Bay, and K. J. Sernka. 2005. Avian monitoring and risk assessment at the San Gorgonio Wind Resource Area: Subcontract Draft Report May. Phase I: March 1997 – May 1998. Phase II: August 1999 – August 2000. National Renewable Energy Laboratory, in press.

Hunt, W. G. 2002. Golden eagles in a perilous landscape: Predicting the effects of mitigation for wind turbine blade-strike mortality. Consultant Report to California Energy Commission, Sacramento, California.

Smallwood, K. S. 2004. Alternative Plan to Implement Mitigation Measures in APWRA. Unpublished CEC staff report, July. 8 pp.

Smallwood, K. S. 2005a. Estimating combined effects of selective turbine removal and winter-time shutdown of half the wind turbines. Unpublished CEC staff report, June 1. 1 pp.

Smallwood, K. S. 2005b. Distribution of Wind Turbines among Ownership and Tiers of Priority for Shutdown to Reduce Avian Collisions. Unpublished CEC staff report, July 21. 1 pp.

Smallwood, K. S. and L. Spiegel. 2005a. Assessment To Support An Adaptive Management Plan For The APWRA. Unpublished CEC staff report, January 19. 19 pp.

Smallwood, K. S. and L. Spiegel. 2005b. Partial Re-assessment of An Adaptive Management Plan For The APWRA. Unpublished CEC staff report, March 25. 48 pp.

Smallwood, K. S. and L. Spiegel. 2005c. Combining biology-based and policy-based tiers of priority for determining wind turbine relocation/shutdown to reduce bird fatalities in the APWRA. Unpublished CEC staff report, June 1. 9 pp.

Smallwood, K. S., and L. Neher. 2004. Repowering the APWRA: Forecasting and minimizing avian mortality without significant loss of power generation. California Energy Commission, PIER Energy-Related Environmental Research. CEC-500-2005-005. 21 pp.

Smallwood, K. S. and C. Thelander. 2004. Developing methods to reduce bird mortality in the Altamont Pass Wind Resource Area. Final Report to the California Energy Commission, Public Interest Energy Research – Environmental Area, Contract No. 500-01-019. Sacramento, California. 531 pp.

Smallwood, K. S. and C. Thelander. 2005. Bird mortality at the Altamont Pass Wind Resource Area, March 1998 – September 2001 Final Report. National Renewable Energy Laboratory, NREL/SR-500-36973. Golden, Colorado. 410 pp.

Response to Attachment 7 of California Wind Companies Comments Received on the Assessment of Avian Mortality From Collisions and Electrocutions (Avian White Paper) August 30, 2005

WRITTEN COMMENTS

All comments are verbatim from Attachment 7 of the California Wind Companies comment letter

Responses provided by Commission staff and Dr. Smallwood lead author of *Developing Methods To Reduce Bird Mortality In The Altamont Pass Wind Resource Area.*

Executive Summary, first paragraph

WEST-1: We offer the following comments on the CEC Staff Report Assessment of Avian Mortality from Collisions and Electrocutions (Staff Report, Melinda Dorin and Linda Spiegel, June 2005 CEC-700-2005-015 hereinafter referred to as "Staff Report"). These comments are made at the invitation of CEC and in the spirit of providing scientific evaluation to reduce avian fatalities at the Altamont Pass Wind Resource Area. We have been consulting with the California Wind Companies to develop an Adaptive Management Plan designed to significantly reduce avian fatalities at the APWRA while maintaining a viable wind power industry. We believe strongly there is a need for a full and complete scientific peer review of the August 2004 CEC report and of all subsequent PIER staff reports (and assessments based on those reports) in the context of proposed management actions to reduce avian fatalities.

Staff Response: The statement that Smallwood and Thelander (2004) has not been subject to scientific peer review is untrue. WEST makes this claim, and yet attached their own review, dated **July 7, 2004** to their comment letter. (This letter, with responses by Smallwood and Thelander, is attached as Appendix A.) It was also reviewed by independent scientists, and by the California Department of Fish and Game and the U.S. Fish and Wildlife Service. Furthermore, all subsequent staff assessments produced on this topic over the past year were delivered to WEST, but WEST never provided review comments on them. We also request that all WEST reports on this topic receive similar peer review before being adopted.

Executive Summary, area 1

WEST-2: The Staff Report should include a much more comprehensive literature review of the impacts of wind turbines on birds. The report focuses primarily on CEC PIER sponsored research, but could be improved by including other monitoring and research conducted outside California.

Staff Response: The Staff Report was not intended as a scientific document, and so a comprehensive literature review was inappropriate. The Staff Report relied heavily on Smallwood and Thelander (2004) for the Altamont Pass Wind Resource Area discussion, however, which provided a comprehensive literature review, including an analysis of wind turbine-caused avian mortality outside the APWRA and outside California. Staff also reviewed the status of research and wind projects in the four other primary wind resource areas in California.

Executive Summary, area 2
WEST-3: We disagree with some of the statistical methods, assumptions, and the subsequent results in CEC reports and technical memorandum used as a basis for the Staff Report. We believe these problems lead to some inappropriate conclusions in the Staff Report.

Staff Response: As pointed out above, WEST already commented on the Smallwood and Thelander (2004) report, and they received responses to their comments. Furthermore, Smallwood and WEST have engaged in several discussions to better educate WEST on the statistical methods and assumptions used to derive at conclusions (see attachment).

Executive Summary, area 3
WEST-4: We think the discussion of avian mortality from the High Winds project could be strengthened by comparing the mortality estimates, raptor use estimates, and risk indices (ratio of the two) from that site to other similar "new generation" windplants, which are very unlike the Altamont wind development. Bat mortality is also discussed at High Winds and could be strengthened by comparing those results with results from other projects in the west. Background fatality estimates from other studies should also be discussed, especially given the large intervals between searches.

Staff Response: Smallwood and Thelander analyzed and discussed the similarities and differences of the APWRA's bird mortality versus other wind farms. As a function of bird use of the site, turbine-caused mortality in the APWRA resembles mortality reported at new generation wind farms (see Chapter 5 of Smallwood and Thelander 2004), but in terms of total numbers of raptor fatalities, the APWRA differs from other new generation wind farms where monitoring has been performed and results reported.

There is no reason to assume new generation wind farms would kill fewer birds, based on turbine attributes. Little monitoring has been performed or reported at new generation wind farms, so it is premature to conclude they are different. However, Smallwood and Thelander (2004) recommended the APWRA be repowered, though carefully, so that the new turbines are on towers tall enough to reduce the encounter frequencies between raptors and the rotor planes, and so that new turbines are sited on portions of the landscape less traversed by raptors.

The High Winds project is the first project in California that has surveyed for bat fatalities. No comparisons can be made from this project to other projects in California since bat deaths were not investigated. Bat fatalities, like bird fatalities appear to be a localized issue.

Executive Summary, area 4

WEST-5: Presentation of raptor use estimates among different wind resource areas should include a discussion of the assumptions and methods including the size of the areas surveyed and survey durations.

Staff Response: Smallwood and Thelander (2004) provided the methodological details recommended by WEST, Inc. as they relate to comparing mortality estimates among wind farms. The Staff Report cited appropriate literature but felt that it was not necessary to reiterate that level of methodological detail in this report.

Executive Summary, area 5

WEST-6: Baseline fatality rates are based on searches conducted on average approximately once every 50 to 90 days, and are not based on site specific scavenging and searcher efficiency adjustments. Most studies of avian fatalities at wind plants conduct searches on intervals of 30 days or less and include site specific scavenging and searcher efficiency studies when the objective is to estimate fatality rates. Inconsistencies in raptor mortality estimates in the August 2004 CEC staff report, which vary by as much as 50 to 90% are likely unreliable for use in evaluating management measures and need to be reviewed.

Staff Response: WEST, Inc. argues that the fatality search intervals were too long in Smallwood and Thelander (2004) to serve as foundation for reliable mortality estimates. However, we note that WEST, Inc. generated mortality estimates for Tehachapi and San Gorgonio wind farms, even though their fatality search interval at these sites was 90 days. We are confused by the comment, “Inconsistencies in raptor mortality estimates in the August 2004 CEC staff report, which vary by as much as 50 to 90% are likely unreliable for use in evaluating management measures and need to be reviewed.”, because we do not know what is meant by “inconsistencies.” We do not know what the 50 to 90% values refer to -- whether these are the uncertainty ranges per species/group, or the variation in mortality estimates between species, or something else. Finally, we point out the mortality estimates were reviewed, by scientists, by WEST, by the regulatory agencies, and again by three independent scientists on behalf of the National Renewable Energy Lab.

Furthermore, we must point out that WEST relied upon the Smallwood and Thelander (2004) estimates when they took the lead in preparing the EIR for the Buena Vista Wind Energy Project. This EIR presented mortality estimates of selected raptor species as the basis of its impact assessment of the Buena Vista project, and it further used these estimates to assess the likely effectiveness of the proposed mitigation measures. The Buena Vista Wind Power Project EIR was certified by Contra Costa County and it was not challenged by anyone afterwards. We are perplexed that WEST would use the Smallwood and Thelander (2004) estimates to further the Buena Vista project, and now allege they are unreliable.

Executive Summary, area 6

WEST-7: We agree with the Staff Report's assessment that the effectiveness of the management measures proposed by PIER CEC staff is unknown and needs to be tested. Other management measures, such as the seasonal shutdown of turbines, which was proposed by the Wind Companies in the Altamont, also needs to be tested for effectiveness.

Staff Response: We agree and state so in each staff assessment provided to WEST and the Altamont wind operators.

2.0: Comprehensive literature review

WEST-8: This Staff Report uses existing information to draw conclusions about wind power and its impacts to birds and bats. The report appears to focus primarily on CEC-sponsored research conducted in California, and does not consider many sources of literature available outside California at new generation wind projects. There is significant literature available from other new generation wind projects that was not included in the Staff Report. Numerous studies have been conducted at new generation wind projects outside California using standardized methods and metrics that would be useful for this report. The analysis in this report demonstrates why the comprehensive literature review is important.

Staff Response: See our comment above regarding the literature review. Many wind farms outside California are different in size and turbine design and do not necessarily have the same level of bird use and issues. The Staff Report was specific to California and therefore, focused on issues relevant to California.

3.0: Statistical Analysis

WEST-9: Many of the conclusions in the Staff Report were based on the August 2004 CEC report and subsequent reanalysis of the data contained in that report. We have several statistical concerns about the interpretation and summary of these research results in the Staff Report. We also have concerns with the some of the statistical analysis in the August 2004 CEC report, which were offered to CEC over the past year, including a formal set of comments submitted prior to the release of the August 2004 CEC report (see Attachment A).

Staff Response: As WEST states they provided comments prior to the release of the August 2004 report. Therefore, we are mystified by WEST, CWC, and CalWEA, KWEA's repeated comments that the report was released prior to their review. Concerns about the statistical analysis were responded to WEST prior to the release of the August 2004 report (Attached) and in several subsequent meetings and conversations with WEST. The fact remains that, as scientists, we disagree with many of WEST's arguments.

3.1

WEST-10: Mortality and Collision Risk at High Winds and Other Wind Project Areas

The Staff Report characterizes the High Winds facility (HW) as an area with a "high rate of bird mortality," when compared to other wind facilities. The observed fatality rate (i.e., # fatalities/MW/year) is lower than rates observed at the Altamont Pass Wind Resource Area (AP), even though, on average, searches were conducted much more frequently at the HW facility (-14 day search intervals) compared to the CEC study in the AP (50 to 90 day search intervals). Our preliminary calculation of potential differences in collision risk at the HW and the AP suggest that the greater rates of raptor fatalities at the HW can be partially accounted for by differences in raptor use (Table 1). Based on a commonly used collision risk index (ratio of fatality rate to raptor use; see Anderson et al. 2004, Anderson et al. 2005, Smallwood and Thelander 2004), and under the assumptions that the methods used do not greatly bias results, the AP appears to present higher collision risk for raptors than HW (Table 1).

TABLE 1: COMPARISON OF USE, UNADJUSTED FATALITY RATE, AND RISK INDICES. AP=Altamont Pass, raptor use estimates from Table 29, Kerlinger et al. (2005), all raptor use estimate from Smallwood and Thelander (2004), unadjusted fatality rates from Smallwood and Thelander (2004). HW=High Winds, raptor use estimates from average of pre- and post- construction estimates from Kerlinger et al. (2005); fatality estimates calculated from same report, Table 4. For illustration.

	Raptor Use (#/20-min survey)		Unadjusted Fatality Rate (#/MW/yr)		Risk Index (Fatality Rate/Raptor Use)	
Species/Group	HW	AP	HW	AP	HW	AP
American kestrel	0.68	0.09	0.24	0.13	0.35	1.44
Red-tailed hawk	1.40	0.64	0.08	0.36	0.06	0.56
Golden eagle	0.25	0.33	0.01	0.10	0.04	0.30
All raptors	3.36	~2	0.35	1.1	0.10	0.55

For example, based on the studies used, American kestrel use at HW is estimated to be approximately 7 times greater than at AP, yet the fatality rate for the same species is only approximately twice as high at HW. Thus, the collision risk index for the likelihood that an American kestrel will collide with a wind turbine at HW is lower than at AP. Even potentially larger differences in risk are shown for other species/groups analyzed; including golden eagle, red-tailed hawk, and all raptors suggesting HW presents a much lower risk than AP. We consider this information preliminary due to the on-going monitoring conducted in HW and AP and because of possible biases due to different methodologies in the two studies. However, we recommend a more thorough review of this and other similar information collected at other wind projects be included in the Staff Report.

Staff Response: WEST, Inc. states in their Table 1 legend they took raptor use estimates from Smallwood and Thelander (2004) in order to calculate the risk indices they compare in their Table 1. However, we cannot surmise how WEST relied on Smallwood and Thelander (2004) for the behavior data presented in their Table 1, because Smallwood and Thelander (2004) did not report on the number of birds observed during their behavior sessions (which were 30 minute sessions, and not 20 minute sessions shown in WEST's Table 1). Smallwood and Thelander (2004) reported on the number of one-minute sampling intervals birds were observed flying or perching, but they did not report the number of birds observed during the session. For the latter information, one would have to read Smallwood and Thelander (2005), which is the NREL report. Furthermore, Smallwood and Thelander (2004) did not calculate their risk indices using unadjusted mortality estimates; they made adjustments to the estimates they used so the resulting indices would be comparable. WEST, Inc. apparently did not do this. Without more information about how WEST came up with their indices, and without an explanation why mortality estimates were not adjusted to account for methodological differences between studies, we cannot respond intelligently to Table 1 or what the indices mean.

3.2: Bat mortality

WEST-11: We believe the Staff Report should provide more discussion of bat mortality at wind projects by including the many reports and publications relative to bat mortality at new wind projects in the U.S. Bat mortality has been documented at all wind projects, and most studies outside California have attempted to estimate associated fatality rates (Johnson et al. 2004). A thorough review would show that the bat mortality observed at HW appears relatively consistent with the levels of bat mortality observed at other new generation wind projects in open habitats of the western and Midwest U.S. (Johnson 2004).

Staff Response: Bat mortality and the significance of bat mortality is localized, so comparison of bat mortality at High Winds to mortality estimates in the eastern U.S. are not relevant to this report. Comparing bat mortality estimates among wind farms within California and among fatality sources is relevant. The fact remains that the level of bat mortality at High Winds was not anticipated nor accounted for in pre-construction environmental reviews, and was therefore surprisingly high.

3.3: Raptor use estimates

WEST-12: We believe the Staff Report should specifically identify the source of each raptor use value in the graph, describe the methods used for each estimate, and describe the method used to standardize the data to a common metric. Also, we believe the reference to Orloff (1992) at the bottom of the figure should be Orloff and Flannery (1992). One concern we have with the reporting of raptor use from different studies in the Staff Report is that the methods of data collection differed among studies, and these differences may bias the comparisons. We have a similar concern about this issue in the August 2004 CEC report. For example, methods were different among the studies included in figure 4-7 on page 85 of Smallwood and Thelander (2004). The viewshed used by biologists for estimating raptor use in the August 2004 CEC study appears to be 300 m. The recent studies at Tehachapi Pass and San Gorgonio use only observations of birds within 200 m of the observers to compare raptor use, however, all birds were recorded out to an unlimited viewshed (i.e., record all birds seen). The studies referenced in Figure 2 in the Staff Report also used different survey durations. For example, Orloff and Flannery (1992) used 10-minute scans, Anderson et al.

(2004,2005) used 5-minute scans, and Smallwood and Thelander (2004) used 30-minute scans. We believe the different methods and assumptions should be described and evaluated to determine potential biases for these comparisons. This evaluation of the sensitivity of the estimates to the assumptions would strengthen the statistical confidence in the conclusions.

Figure 2 in the Staff Report presents measures of raptor and avian use at the AP, HW, Tehachapi Pass, and San Gorgonio wind facilities. However, the numbers reported in the figure are not consistent with the numbers reported in the text. For example, the text on page 18 states that Orloff and Flannery (1992) estimated 2.3 raptors/10-minute scan in the fall, while the value in Figure 2 used is 1.68 raptors/10-minute scan. Also, the raptor estimate in Figure 2 for AP for all seasons is larger than the all-bird estimate (1.26 versus 1.07), which is not possible unless the sources for the raptor and for the all-bird estimates are different. Based on the references listed below the table, we suspect that some of the estimates in Figure 2 for the AP are from Smallwood and Thelander (2004), while the text reports the data from Orloff and Flannery (1992). We also believe there is more contemporary data that has been collected in the HW area (e.g., Kerlinger et al. 2004) and should be utilized.

Staff Response: WEST, Inc. warns against comparing raptor use among wind farms due to differences in methodology that was used at the various wind farms, yet in comment WEST-10, WEST themselves compared raptor use between two wind farms, even though the data collection methods to characterize both mortality and raptor use differed between these two wind farms. In comparing mortality and raptor use estimates between the APWRA and High Winds projects, WEST did not describe differences in methods used to collect the data, nor how these differences were dealt with to minimize bias. As a comparison of the differences in approach between WEST and Smallwood and Thelander (2004), we reproduce text from the Methods section of Smallwood and Thelander (2004), Chapter 5, which compares mortality and raptor use among wind farms.

“We reviewed published reports of bird mortality at wind energy facilities, and we extracted from those reports the mortality estimates and associated attributes of the study. Studies from which we collected mortality estimates and related data included Howell (1997), Howell and DiDonato (1991), Howell et al. (1991), Howell and Noone (1992), Orloff and Flannery (1992), Kerlinger (2000), Howe (2001) (c.f., in Erickson et al. 2001), Strickland et al. (2001a,b), Thelander and Rugge (2001), Johnson et al. (2002), Erickson et al. 2003, Anderson et al. (in review, a; in review, b), and Smallwood and Thelander (2004). Data were also collected from Janss and Clave (2000) and Winkelman (1989, 1992), but not used in the analyses reported herein because they involved wind farms in Europe.

The extracted data were organized into a spreadsheet for synthesis. We recorded whether the mortality estimate was based on raw numbers of fatalities or whether they were adjusted by scavenging rates, detection bias, or other factors, and we recorded whether the estimate included only fatalities caused by wind turbine collisions or whether they included all fatalities caused by all facilities and human activities at the wind farm. We recorded the number and types of wind turbines used to generate the estimates, as well as the span of time used for monitoring for bird carcasses. We also recorded the carcass search radius, scavenging rates, searcher detection rates, and search interval in days. Site location was recorded along with the year of the estimate. Multi-annual studies were represented by the middle year when annual estimates were not provided.

For the purpose of comparing estimates among project sites, we needed to standardize the mortality estimates to the extent possible. For example, because we found 11.2% of the bird carcasses outside our 50-m search radius in the APWRA, and because our sample of bird fatalities was larger than recorded at any other wind energy facility or related study, we relied on our rates of carcass detection within distance intervals from the wind turbines to adjust the mortality estimates reported in the other studies we reviewed. For example, Orloff and Flannery (1992) searched out to 30.7 to 61.4 m from wind turbines, and within 30.7 m we found 68.6% of all our bird carcasses and 65.6% of all our raptor carcasses. We assume that Orloff and Flannery would have missed up to 34.4% of the raptor carcasses and 31.4% of all the bird carcasses that we found. Additionally, we assume that we missed half the carcasses beyond our 50-m search radius, and that Orloff and Flannery would have missed these also (our only basis for this assumption is experience in the field, and so represents our professional judgment). Adding in our assumed error rate translates to Orloff and Flannery's finding of 57.4% of all bird carcasses found within 30.7 m and 51.4% of all raptor carcasses found, all other factors not considered. Therefore, we adjusted Orloff and Flannery's mortality estimates by dividing them by 0.574 for all birds and 0.514 for raptors.

For each reported search radius equal or larger to 50 m, we identified the proportion of bird carcasses we found beyond that radius and multiplied it by two (again, assuming a 50% miss rate). This product was divided into the reported mortality estimate. We did not adjust reported mortality estimates by scavenging rates, searcher detection rates, or search intervals because these attributes were too scant in the literature to be useful at this time. In some cases, mortality estimates were already adjusted by these factors, but in most cases they were not. The reported scavenging rates were reported in two formats: (1) percent of carcasses remaining after so many days, and (2) the number of days until all carcasses were removed. The use of both formats among research reports was an inconsistency that prevented reliable adjustments for scavenging in our synthesis. Search intervals were usually reported, but we could not adjust the mortality estimate by this factor without within-study reporting of the variation in mortality due to variation in search interval."

Note the level of methodological detail in the Smallwood and Thelander (2004) report that is missing from the comparison of mortality and raptor use provided by WEST. WEST provided almost no detail of their comparison, whereas Smallwood and Thelander (2004) provided the level of detail typical of scientific journal publications. We also refer the reader to Erickson et al. 2001 for a comparative analysis performed by WEST which compares avian fatalities from wind collisions to those from other sources of collisions, but based on grossly disparate methodologies.

3.4.1: All bird fatality estimates

WEST-13: All bird fatality rates included in the Staff Report are a potential metric for comparing the risk to birds among the AP wind resource area and other wind developments, and could potentially be used to estimate the effectiveness of risk reduction management proposed by the companies. However, the study design used in the research described in the August 2004 CEC report was most appropriate for relating the location of raptor fatalities to the physical and biological characteristics for those locations and not for estimating an all-bird fatality rate. The lower end of the range of fatalities (1,766 birds) is based on the actual number of birds found during the study with a search detection correction and the upper end of the range (4,721 birds) includes an additional adjustment for scavenging. Scavenging and searcher efficiency data for theses adjustments are based on other studies including a project we conducted in Oregon and Washington (Erickson et al. 2004) and Orloff and Flannery (1992). Based on the correction factors identified for small birds for scavenging in the August 2004 CEC report, it appears the method of adjustment assumes all birds died approximately 40 days before the search, rather than at random times between searches. This would tend to overestimate the fatality rate of small birds, even if the Stateline estimates were appropriate for the AP. The August 2004 report also applies the small bird scavenging rate from the Stateline study to medium-sized birds in the AP study (e.g., rock dove), also potentially overestimating the fatality rates of these birds.

The CEC study also used wide intervals between searches (mean is approximately 53 days for the first sampling set, and 90 days for the 2nd sampling set). We believe these wide search intervals and the lack of site-specific searcher efficiency and scavenging rates significantly reduce the reliability of fatality estimates for small and medium sized birds in the August 2004 CEC report (Attachment A). A similar large interval between searches at the Tehachapi Pass and San Gorgonio Wind Projects was the primary reason why Anderson et al. (2004) did not attempt to make all-bird fatality estimates. We welcome further discussions on this issue with the authors.

Staff Response: We concur with WEST, Inc. that the fatality search methods used in Smallwood and Thelander (2004) were more appropriate for estimating fatality associations with measured variables than they were for estimating mortality. Smallwood and Thelander (2004) were clear on this point. Mortality was also estimated using the best available information on scavenging and searcher detection rates, and after making certain, clearly stated assumptions. Assuming one or more of Smallwood and Thelander's (2004) estimates was incorrect, it is our assessment that such errors in the assumptions could result in trivial levels of over-estimation, or trivial levels of under-estimation of mortality.

WEST, Inc. states their belief that the fatality search intervals used by Smallwood and Thelander (2004) were too long to be relied upon for mortality estimation. However, WEST, Inc. not only made mortality estimates at Tehachapi and San Gorgonio where 90-day search intervals were used, but they did so for individual wind turbines for the purpose of testing hypotheses of correlation between mortality and turbine attributes and environmental variables. Estimating mortality per turbine was inappropriate because the majority of the estimates would be 0 for studies of duration similar to Tehachapi or San Gorgonio, and the majority of the mortality estimates at the small number of turbines where fatalities were found will be derived from one fatality. Perhaps one or two turbines will have killed two or more birds, and even these mortality estimates will be small fractions of one with confidence intervals extending well to the negative of zero, which is what happened at Tehachapi and San Gorgonio, and which made little sense. Given the frequencies of bird collisions at old-generation, small wind turbines, it makes more sense for both biological and statistical reasons to estimate mortality per turbine string rather than per turbine. At the per-turbine level of analysis it makes more sense to simply compare the number of fatalities found at each turbine (again, most will be 0, some will have 1, and one or two might have 2 or more fatalities), so long as fatality search interval is equal. Statistical test assumptions are much more closely met by comparing fatalities among turbines in chi-square tests than by comparing per-turbine mortality estimates in ANOVA tests. This is because rates used in ANOVA tests and correlation analysis are treated as representative of the statistical universe, whereas frequencies used in chi-square tests are treated as sample-specific.

According to WEST-13, “A similar large interval between searches at the Tehachapi Pass and San Gorgonio Wind Projects was the primary reason why Anderson et al. (2004) did not attempt to make all-bird fatality estimates.” However, Anderson et al. (2004), which is co-authored by five WEST employees, wrote, “Total bird fatality over the entire Tehachapi WRA was 0.086 carcasses/survey.” This, in fact, was a mortality estimate. Later in the same report, Anderson et al. (2004) provided the caveat that mortality estimated from a study using 90-day search intervals will have high uncertainty, but then they provided an annual mortality estimate anyway. The reason they did so was the same reason Smallwood and Thelander (2004) did so: because the data are available and too important to not make the most use of them, even if the underlying assumptions are more uncertain than desired. It would be negligent of us as scientists to not estimate mortality when we have data available to do so, just as it would have been negligent of Smallwood and Thelander (2004) to not use what they learned to recommend that future fatality monitoring continue three years at the minimum.

3.4.2: Inconsistency of raptor mortality estimates

WEST-14: The raptor fatality data contained in the August 2004 CEC report will serve as the baseline for determining the effectiveness of the proposed management measures for reducing raptor mortality. However, we are concerned about some apparent inconsistencies in the tables of fatality rates in the August 2004 CEC report. Individual raptor species mortality estimates, when summed, were significantly less than the value reported for raptors combined (see for example, Table 3.9 and Table 3.1 1).

From Table 3.9, Page 70, August CEC report

Species/Taxonomic group	Mortality (deaths/MW/year) First Set	2nd Set
Ferruginous hawk	0.0000	0.0348
Northern harrier	0.0027	0.0000
Prairie falcon	0.0042	0.0000
Turkey vulture	0.0098	0.0000
Great horned owl	0.0245	0.0040
Golden eagle	0.0380	0.1391
American kestrel	0.0614	0.1251
Barn owl	0.0662	0.0292
Burrowing owl	0.1674	0.1000
Red-tailed hawk	0.2953	0.2490
All raptors (Table 3.9)	0.9526	1.2332
All raptors (sum above)	0.6695	0.6812

Note that the estimate for all raptors at the bottom of the table is 0.67MW/year for the first set and 0.68MW/year for the second set, which is nearly identical. However, the number reported for all raptors in the bottom of the table is 50% higher in the first set, and 90% higher in the 2nd set. The lead author indicated to us in an email that the primary reason for this discrepancy was that some species were omitted from table 3.9. However, the August 2004 CEC report (page 64, Table 3.1) confirms that the species listed in Table 3-9 include all the raptor species that were included in fatality estimates. The difference in the unadjusted fatality rates for the entire AP is as much as 300 raptors depending on which method is used. This difference in total mortality is even more exaggerated when assumptions are made regarding searcher efficiency and scavenging bias. We believe that this discrepancy should be clarified before a final decision is made on baseline fatality rates for testing of management measures.

Staff Response: Smallwood discussed this issue of baseline estimates with WEST on the phone several times, and both agreed it would make more sense to use the raw mortality estimates until scavenger removal and searcher detection trials are performed specifically in the APWRA. They agreed that scavenger removal and searcher detection terms derived from those trials should be applied to the raw mortality estimates from both Smallwood and Thelander (2004) and future estimates in order to arrive at comparisons for the purpose of assessing mitigation effectiveness. We further note that comparing mortality estimates from before and after mitigation measures are implemented is not the only means to testing the effectiveness of mitigation measures. Testing for association between fatalities and variables related to the mitigation measures is another means to this end.

Smallwood and Thelander originally intended to present mortality estimates only of individual species, and only for those species represented by more than one turbine-caused fatality discovered during the study. The reason they originally restrained themselves this way was because the adjustment factors used to calculate mortality estimates were more reliably applied to species with more than one fatality. (Adjustment factors were made for turbine-caused bird fatalities undiscovered beyond the 50-m search radius, searcher detection of carcasses within the search radius, and the rate of scavenger removal of carcasses.) The smaller the sample size, the more radically the adjustment factors will alter the magnitude of the estimate, resulting in increasingly larger ranges between the low and high adjusted mortality estimates. Therefore, Smallwood and Thelander (2004) chose not to estimate mortality for individual species represented by only one turbine-caused fatality.

Regardless of their original intention, Smallwood and Thelander (2004) pooled all raptor species and all bird species together into independent mortality estimates, because both the Altamont operators and U.S. Fish and Wildlife Service requested they do so. These ‘all raptor’ and ‘all bird’ estimates were added to the tables of mortality estimates, which listed fatalities and mortality estimates by individual species so the readers can understand exactly the facts behind the numbers.

Mortality adjustments applied to individual species were readily extended to the ‘all hawks’ group, because this group was composed of species sharing the facts they were raptors and also categorized as large-bodied (specific adjustments had been made according to these categories when estimating mortality of individual species). Mortality adjustments were extended to the ‘all raptor’ group nearly as reliably, although this group included two small-bodied raptor species (American kestrel and burrowing owl), which complicated the adjustments and ended up with an all raptor estimate that did not equal the sum among species. Also, there were some carcasses in this group that could not be identified to species, so the mortality adjustments were more prone to error than they were for the ‘all hawks’ group. However, Smallwood and Thelander felt confident their ‘all raptor’ mortality estimates were reasonable.

The ‘all bird group’ was the most complicated when it came to estimating mortality, especially when it came to applying scavenger rates to adjust the estimates. This group included many more carcasses that were not identified to species, so they were unsure about which of the available scavenger removal terms to apply to this group. Smallwood and Thelander decided to take the mean between scavenger rates applied to the small-bodied and large-bodied species, and then multiply it by 1.5. Thus the scavenger removal terms of 0.198 and 0.414 applied to small-and large-bodied species found among Set 1 turbines were used to calculate their mean of 0.306, which was multiplied by 1.5 to arrive at the ‘all birds’ scavenger removal term of 0.459 for carcasses found among Set 1 turbines. The scavenger removal terms of 0.098 and 0.314 applied to small-and large-bodied species found among Set 2 turbines were used to calculate their mean of 0.206, which was multiplied by 1.5 to arrive at the ‘all birds’ scavenger removal term of 0.309 for carcasses found among Set 2 turbines. The factor 1.5 was used because the smaller scavenger removal rate that had been used on individual raptor species, as well as on the ‘all hawk’ and ‘all raptor’ groups, had not yet been applied to the ‘all birds’ group, nor could it be applied in the straightforward manner it was applied to the other groups (and species).

Smallwood and Thelander's (2004) scavenger removal rate adjustment to the 'all birds' group resulted in a substantial deviation from the other low- and high-end estimates calculated for individual species and for the 'all hawks' and 'all raptors' groups, as well as a deviation from the low-end of the 'all birds' group estimate in terms of its magnitude relative to the sum of the species estimates shown in Table 3-11. This deviation resulted from a separate methodology used to arrive at this one estimate, i.e., the high end of the uncertainty range estimated for 'all birds.' Another scientifically defensible approach would be to sum the high end estimates among the species shown in Table 3-11, then add to this sum an educated guess of the mortality among species not shown in Table 3-11, including the carcasses not identified to species. This latter approach might yield an upper-range turbine-caused mortality estimate of about 11,000 birds per year in the APWRA, and it would be consistent with the approach used per individual species.

Both approaches are scientifically defensible, and both indicate that thousands of birds are killed each year by wind turbines in the APWRA, so both are consistent with the main point of the mortality chapter in Smallwood and Thelander (2004). Both indicate high uncertainty about the total number of birds killed by collisions with wind turbines in the APWRA, and both indicate that despite this uncertainty the annual turbine-caused mortality is in the thousands of birds. Continued, scientifically defensible monitoring of fatalities in the APWRA could yield a more reliable mortality estimate, although we hope that significant measures are taken immediately to reduce wind turbine-caused mortality.

We agree that the assumptions leading to extrapolations from raw mortality estimates to adjusted estimates should be clarified, as noted above. This clarification can come from scavenger removal and searcher detection trials performed as part of fatality monitoring extended into the future as part of a mitigation strategy. Performing such trials was not part of the scope of work of the Smallwood and Thelander study, but it should be performed as part of the next phase of monitoring. However, Smallwood continues to disagree with the scavenger removal and searcher detection methodologies advocated by WEST (via phone calls, emails and reports). Smallwood believes that birds actually killed by wind turbines should be left where they are found, and subsequently monitored. The turbine operators did not allow Smallwood and Thelander to leave carcasses where found until the last month of their study, which was too late. But this approach would be preferable to placing chickens or any other species that is not common to the area, and which are likely more attractive to mammalian carnivores than birds typically killed by the wind turbines. Searcher detection trials should also make use of turbine-killed bird carcasses because the species advocated by WEST for such trials differ in conspicuousness from the species actually killed.

3.4.2

WEST-14: We also believe there may be some additional adjustments necessary prior to finalizing the baseline fatality rates for evaluation of management measures. A few database errors have been identified that would have some effect on the values in

Table 3.9, and in other analyses such as modeling of high risk turbines. We recognize that all large field collected data sets such as the AP data have the potential for errors. Through our review of the data we have been given to date we identified several potential errors in the summary data set that we previously communicated to CEC. For example, the turbines at the City of Santa Clara site were incorrectly classified as Kenetech 56-100 turbines (-200 turbines), but are upwind Vestas V-17 and V-19 model turbines. Several of these turbines were also incorrectly classified as windwall turbines. This latter error was detected by the CEC scientists and discussed in Smallwood (2004).

A more recently discovered error was also communicated verbally to the CEC scientists. Many turbines sampled at the Patterson Pass Site that are 65-kW turbines (approximately 200) were incorrectly classified as Bonus 150-kW turbines. This error and the misclassification of turbines at the Santa Clara site and the Patterson Pass site could influence the risk models in the August 2004 CEC report and subsequent reports (Smallwood and Thelander 2004, Smallwood 2004, Smallwood and Spiegel2005a, 2005b, 2005c), since the windwall classification, turbine model, and turbine size are factors included in some of the risk models. These errors could also have some effect on the fatality rate estimates provided in the August 2004 CEC report. However, we do not know the degree to which the results would be affected if the errors were corrected without reviewing the underlying data. We have only received a partial data set, and it appears that ths data set still contains the misclassified turbines from the Patterson Pass Site.

Staff Response: WEST, Inc. states that an error was made in classifying the turbine models owned by the City of Santa Clara. Smallwood and Thelander (2004) asked the wind companies to identify all the turbine models in the APWRA. Smallwood and Thelander did not receive a list of wind turbine models from Joan Stewart until after field work was completed and the final report was on the verge of being distributed by the CEC. This list included Vestas turbines, but these were 100-kW turbines, which are the same size as the KCS-56 turbines Smallwood and Thelander classified them as, meaning the mistake was trivial.

WEST, Inc. states the “CEC scientists” (meaning Smallwood and Thelander) detected an error in their classification of some wind turbines as wind wall turbines. This is not true. Based on the definition being used at the time, Smallwood and Thelander (2004) regarded these turbine strings as wind walls, whereas Smallwood later changed his definition of wind wall, and subsequently made some changes to the data set. These changes would in no way affect the mortality estimates.

WEST never communicated to Smallwood that they identified a misclassification of about 200 150-kW turbines at the Patterson Pass site as 65-kW turbines. We agree that if it seems this would affect the baseline data, a re-analyses using the corrected information could be performed.

3.4.3: Cause of death determination and background mortality

WEST-15: During the workshop on June 28, 2005, there was discussion regarding the determination of cause of death for fatalities found during the CEC study. Given the large interval between searches in the CEC study, many of the carcasses were old and desiccated which made it difficult to assign cause of death. Most carcasses that were found were considered turbine-related. However, there is likely some background mortality that is included in the turbine-caused fatality rate estimates. An unknown number of the fatalities likely are caused by other factors not related to collisions with the wind facility (e.g., caused by raptors, coyotes, collision with vehicles, and other structures). No comparable information on background fatality rates is known for the AP.

A few studies at wind projects have provided information on background mortality. During a four-year study at Buffalo Ridge (Minnesota), 2,482 fatality searches were conducted on study plots without turbines to estimate background mortality (Johnson *et al.* 2000). Thirty-one avian fatalities were discovered in the plots without turbines consisting of 15 species including eight upland game birds, seven doves, five sparrows, three waterfowl, three raptors, two blackbirds, one waterbird, one shorebird, and one unidentified bird. Background mortality averaged 1.1 fatalities per plot per year, and ranged from 0.98 to 4.45 fatalities per turbine search plot per year in different portions of wind resource area (Johnson *et al.* 2000). Some pre-project carcass searches were conducted at a proposed wind project in Montana (Harmata *et* al. 1998). Three bird fatalities were found, two presumed raptor kills and another from an unknown cause during 8 searches of 5 transects, totaling 17.61 km per search. A similar result was observed at San Gorgonio, where the observed fatality rate at the wind turbine plots was only approximately 25% higher than the reference fatality rate (Anderson et al. 2005).

We agree that background mortality likely varies among species and groups. The study of seasonal shutdown in the AP will provide some information on mortality unrelated to collision with moving turbines. Given the high degree of scrutiny, and proposals by some to consider mitigation for individual dead birds, it may be very important to quantify background mortality at AP.

Staff Response: As shown in Figure 2-3 (that is already duplicated as part of the staff response to Carol Weisskopf; CW-6) of Smallwood and Thelander, most fatalities attributed to collisions with turbine blades had injuries that would be unlikely caused by other sources. These included severed wings, tails, heads and cut torsos. Even if background mortality was greater than the 1.1% of fatalities reported by Smallwood and Thelander (2004), we contend the under-estimate would have made little substantive difference to the wind turbine-caused mortality estimates. It is important to remember, too, that Smallwood and Thelander’s (2004) mortality estimates were specific to wind turbines, and did not include fatalities caused by electrocutions and collisions on electric distribution lines servicing the APWRA, or caused by collisions with automobiles servicing the APWRA.

It should be noted that in the reference cited by WEST, Johnson et al (2000), to conduct a study to estimate background mortality, the authors concluded that there was too little natural mortality to continue with that effort and decided to attribute all mortality to wind turbines. In addition, the lead author of the San Gorgonio study stated in a personal communication that there was too little mortality not caused by turbine blades in wind farms to justify the time and cost of the effort and that nearly all fatalities were turbine-caused (Richard Anderson, personal communication July 2005). In their report of bird collisions with wind turbines in the Stateline project, WEST did not make any effort to estimate background mortality. In their monitoring plan for the Buena Vista Wind Power Project in Contra Costa County, Erickson and Smallwood (2004) did not include any effort to estimate background mortality, even though the plan was senior-authored by one of the same WEST employees who now contends the Smallwood and Thelander (2004) mortality estimates are too high because they did not account for background mortality.

3.5: Description of management measures and uncertainty

WEST-16: We agree with the Staff Report assessment that the management measures proposed by the CEC need to be monitored to determine their effectiveness (page 25 and 26 of Staff Report). After review of the fatality data from the Wildlife Response and Reporting System (WRRS) and the August 2004 CEC study, and with their knowledge of wind production in the winter period, the companies proposed winter season shutdown of large numbers of turbines as a potential measure and this management method also needs to be monitored for its possible effectiveness.

The August 2004 CEC study is primarily geared toward estimating large-bird fatalities and developing associations between fatality locations and turbine and other physical and biological characteristics. Cause and effect is subjectively determined based on associations between fatalities and environmental variables and turbine characteristics (see comment #3 and other related comments in Attachment A). While these associations do not allow a direct statistical estimation of cause and effect, they did allow the CEC scientists to develop recommendations for management actions. It is important to place these management recommendations in perspective; they are statements of hypotheses and significant uncertainty exists over their potential effectiveness. The Adaptive Management Plan (WEST 2005) proposes an approach to address several of these uncertainties and, in an incremental process, test the management hypotheses.

The uncertainty in the permanent shutdown of high-risk turbines is illustrated by the fact that the CEC Staff and consultants have provided at least five different sets of models and maps of high-risk turbines (Smallwood and Thelander 2004, Smallwood 2004, Smallwood and Spiegel2005a, 2005b, 2005c). In the earlier models, many of the largest turbines in the Altamont were identified as the most risky (e.g., Smallwood and Thelander 2004, Smallwood and Spiegel2005a). In subsequent models, many of the smaller turbines were considered most risky (Smallwood and Spiegel2005b). In the June Assessment (Smallwood and Spiegel2005c), which combines models from the January Assessment (Smallwood and Spiegel2005a) and the March Assessment

(Smallwood and Spiegel2005b), few turbines greater than 200 kW and few turbines smaller than 60 kW are considered high risk (Tiers 1 and 2), and most of the high risk turbines are now 65- 100 kW turbines.

In addition, we have some concerns over the data that have been provided to us to allow us to recommend to the turbine owners which individual turbines are considered high risk. We were given a dataset at the end of January, 2005 that was purported to be the risk values for turbines from the January Assessment. However, we later received another data set identified as the risk values for turbines from the January Assessment (received July 2005) that appears to be very different than the dataset previously identified as the results of the January Assessment. We have asked for clarification of the different data sets, and also asked for more detailed dataset than includes the risk values for each of the models in the same dataset, but these requests have not been meet to. Variables considered in the various risk models have changed. For example, turbine type (tubular versus lattice) was considered an important variable in predicting risk for red-tailed hawks in the initial models (Smallwood and Thelander 2004, Smallwood 2004), and was discussed in the executive summary of the August 2004 CEC report as an important variable, but models developed later no longer considered this an important variable (Smallwood and Spiegel2005a).

While we discussed these issues with the CEC staff on several occasions, we believe this uncertainty illustrates the need for careful evaluation of proposed management actions before broad scale application.

The August 2004 CEC report suggests that a relatively high level of fatalities occur in winter (November 15 - January 31). Because power production is, on average, relatively low in this winter period, the companies have proposed to test winter shutdown as a method to reduce fatalities while minimizing lost power production. This additional mitigation measure was discussed with the CEC and US Fish and Wildlife Service and it was considered to be an appropriate management measure. While the calculations in the CEC January report (Smallwood and Spiegel2005a) suggest this management measure might be very effective, there are uncertainties. For example, the estimates of overall fatality reduction may be an overestimate since individual birds that are not killed during the winter because of the turbine shutdown may be killed at another time when the turbines are operating.

Another important assumption in the August 2004 CEC report is that the season when each kill occurred was accurately assigned. Fatalities were estimated at two sets of turbines. The average search interval for the turbines monitored the longest was approximately 53 days, while the average search interval for the 2nd set of turbines (approximately 2500 turbines monitored between November 2002 and May 2003) was approximately 90 days, leading to high uncertainty regarding when the fatality occurred, especially for the second sampling set. For example, we believe it would be very difficult to determine actual age of a carcass that has been desiccating for more than 30 days, making the assignment of month of fatality difficult. It is also not clear to us what affect the differing seasonal search intervals might have on the estimated reductions in fatalities from seasonal shutdowns or in the modeling process for determining high risk turbines. At a minimum, these factors add unknown levels of uncertainty to the predictions. For example, differential scavenging rates among seasons could affect results, and no scavenging studies were conducted.

Another important assumption in calculation of the seasonal fatality estimates is that searcher detection is consistent among seasons. For example, if searcher detection is higher in the winter compared to the other seasons, the effects of a winter shutdown may be underestimated. No searcher detection rates were estimated during the study reported in the August 2004 CEC report (Smallwood and Thelander 2004).

Because of these uncertainties, we have proposed an initial test of the seasonal shutdown hypothesis. The test includes shutting down approximately ½ of the wind turbines in APWRA for a 2-month period (November and December) followed by shutting down the other ½ of the turbines for the following 2-month period (January and February) while restoring the first group of turbines to operation. This approach allows a comparison of the resulting fatality rates per megawatt during the shutdown period to fatality rates in previous years during the same operating period (a Before/After design; see Anderson et. al., 1999) and a comparison of fatality rates at the same turbines during the same season both operating and not operating (Crossover design; see Anderson et. al. 1999). The resulting data will provide an estimate of the fatality rates during 2-month winter segments (i.e., November/December and January/February) and with shorter search intervals, should allow verification of the winter season fatality rates. These data will also be used to further refine the months when winter shutdowns would result in the greatest fatality reduction for a given loss of power production. Statistical power calculations will be used to determine appropriate sample size, and it may be necessary to sample a larger sample in the winter period to answer with adequate certainty which months would result in the greatest fatality reduction.

Staff Response: WEST, Inc. state that in Smallwood and Thelander (2004), “cause and effect is subjectively determined…” from tests of association between fatalities and measured variables. It is obvious that WEST does not understand the basic concepts of hypothesis-testing using inferential statistics (see WEST comment letter submitted July 2004 that makes the completely inaccurate claim that inferences cannot be drawn from inferential statistics). Smallwood and Thelander (2004) did not *determine* any cause and effect relationships, subjectively or otherwise. Rather, they drew inferences from the statistical tests they used, and which those tests were designed to provide. Contrary to the claim made by WEST, Inc., Smallwood and Thelander regarded their inferences to be estimations of fatality associations, and they took additional steps in their analysis to account for possible confounding effects and inter-variable correlations. Smallwood and Thelander (2004) arrived at summaries of associations that they thought were relatively orthogonal and representative of larger factors than the measures specifically measured.

We point out that WEST relied upon fatality associations reported in Smallwood and Thelander (2004) to arrive at mitigation measures for the Buena Vista Wind Power Project, as described in the Biological Resources section of the corresponding EIR.

WEST, Inc. states that uncertainty in Smallwood and Thelander's (2004) management recommendations is "illustrated by the fact that the CEC staff and consultants have provided at least five different sets of models and maps of high risk turbines (Smallwood and Thelander 2004, Smallwood 2004, Smallwood and Spiegel 2005a, 2005b, 2005c)." In truth, the various assessments and map products of Smallwood (2004) and Smallwood and Spiegel (2005a,b,c) had nothing to do with uncertainty in the recommendations of Smallwood and Thelander (2004). These assessments were requested by the operators and WEST, and they relied on results from Smallwood and Thelander (2004) address various mitigation scenarios. The difference is the outcome of selected high risk turbines from these scenarios is not a result of unreliable data sets, but rather from the criteria used, as requested, to run the scenarios. The first assessment of high risk turbines, Smallwood and Spiegel (2005a), was based solely on biological factors. The operators did not like the outcome of this assessment and requested we add the non-biological factor of turbine size (Smallwood and Spiegel, 2005b) so that operators of mostly large turbines would not be disproportionately targeted as having the highest risk turbines, even though this was in fact the case. We then decided to factor in both biological and size criteria in Smallwood and Spiegel (2005c) because the owners of small wind turbines as us to do so after the second assessment identified many small wind turbines as candidates for shutdown or relocation.

These assessments were done in the spirit of cooperation with the operators and WEST to come up with an equitable and yet biologically justifiable solution when determining which turbines to shut down. The basis for each assessment is clearly stated in the introduction of each report.

WEST, Inc. states that the data sets used to produce the Smallwood and Spiegel (2005a,b,c) assessments are inconsistent, and therefore the CEC staff and consultant products unreliable. WEST failed to mention that since May 2004, WEST has produced 5 variations of a management plan for the Altamont that had proposed mitigation measures that required the staff assessments be completed to support these measures. WEST also admits that they in fact proposed the winter-time shutdown, yet most comments received by the industry complain that staff proposed these without regard to understanding the effectiveness of these measures. WEST also cites uncertainty in the staff and consultants reports yet propose to add two surveys per year (2 during the first two months of winter and 2 during the second two months of winter) to add credibility to the existing set. It is highly unlikely that an addition of 2 surveys will add any certainty to the existing database. The CWC's comments repeatedly complain of too few data points from some of Smallwood and Thelander's study yet they endorse the idea of reaching conclusions from 2 surveys per treatment as ample to determine the effectiveness of this treatment.

Section 3.5

WEST-17: Variables considered in the various risk models have changed. For example, turbine type (tubular versus lattice) was considered an important variable in predicting risk for red-tailed hawks in the initial models (Smallwood and Thelander 2004, Smallwood 2004), and was discussed in the executive summary of the August 2004 CEC report as an important variable, but models developed later no longer considered this an important variable (Smallwood and Spiegel2005a).

Staff Response: WEST, Inc. states that variables considered important to red-tailed hawk fatalities changed between the Smallwood and Thelander (2004) report and later assessments, and they specifically point out the change in the use of tower type as a predictor variable. Smallwood and Spiegel (2005a) reported their reason for changing the model used to rate turbines for collision threat to red-tailed hawk, and this reason was the second approach performed much better at predicting red-tailed hawk fatalities among wind turbines. Credible scientists are supposed to make improvements to their approach, if they think the improvements can be made. Indeed, making this change exemplifies that staff's consultants are willing to improve the data analysis when necessary.

Section 3.5

WEST-18: The August 2004 CEC report suggests that a relatively high level of fatalities occur in winter (November 15 - January 31). Because power production is, on average, relatively low in this winter period, the companies have proposed to test winter shutdown as a method to reduce fatalities while minimizing lost power production. This additional mitigation measure was discussed with the CEC and US Fish and Wildlife Service and it was considered to be an appropriate management measure. While the calculations in the CEC January report (Smallwood and Spiegel2005a) suggest this management measure might be very effective, there are uncertainties. For example, the estimates of overall fatality reduction may be an overestimate since individual birds that are not killed during the winter because of the turbine shutdown may be killed at another time when the turbines are operating.

Staff Response: WEST argues that Smallwood and Spiegel (2005a) might have over-estimated the percentage mortality reduction due to winter shutdown of turbines because birds not killed during the winter might get killed by turbines during some other time of the year. Perhaps this speculation is true, but we could also speculate on reasons the estimates are too low. The Smallwood and Spiegel assessments were not intended to be exact, nor were they assigned confidence intervals, on purpose; they were intended to allow for comparison of the relative effectiveness of various mitigation measures under discussion. Estimates are estimates, and these are based on several years of research.

Section 3.5

WEST-19: Another important assumption in the August 2004 CEC report is that the season when each kill occurred was accurately assigned. Fatalities were estimated at two sets of turbines. The average search interval for the turbines monitored the longest was approximately 53 days, while the average search interval for the 2nd set of turbines (approximately 2500 turbines monitored between November 2002 and May 2003) was approximately 90 days, leading to high uncertainty regarding when the fatality occurred, especially for the second sampling set. For example, we believe it would be very difficult to determine actual age of a carcass that has been desiccating for more than 30 days, making the assignment of month of fatality difficult. It is also not clear to us what affect the differing seasonal search intervals might have on the estimated reductions in fatalities from seasonal shutdowns or in the modeling process for determining high risk turbines. At a minimum, these factors add unknown levels of uncertainty to the predictions. For example, differential scavenging rates among seasons could affect results, and no scavenging studies were conducted.

Staff Response: We disagree that the assignment of time since death was prone to high error, but we note that Smallwood and Thelander (2004) purposefully aggregated estimated dates of death into seasons, rather than months of the year, in order to more reliably test for associations between fatalities and time of year. Their selection of season of the year rather than month was intended to reduce the effect of error in assigning date of death to carcasses we found during our fatality searches. Their monitoring of carcasses left in the field also provided the fatality search crews and analysts with the means to calibrate estimates of time since death, so we disagree that this possible source of error posed much of a problem.

Section 3.5
WEST-20: Because of these uncertainties, we have proposed an initial test of the seasonal shutdown hypothesis. The test includes shutting down approximately 1/2 of the wind turbines in APWRA for a 2-month period (November and December) followed by shutting down the other 1/2 of the turbines for the following 2-month period (January and February) while restoring the first group of turbines to operation. This approach allows a comparison of the resulting fatality rates per megawatt during the shutdown period to fatality rates in previous years during the same operating period (a Before/After design; see Anderson et. al., 1999) and a comparison of fatality rates at the same turbines during the same season both operating and not operating (Crossover design; see Anderson et. al. 1999). The resulting data will provide an estimate of the fatality rates during 2-month winter segments (i.e., November/December and January/February) and with shorter search intervals, should allow verification of the winter season fatality rates. These data will also be used to further refine the months when winter shutdowns would result in the greatest fatality reduction for a given loss of power production. Statistical power calculations will be used to determine appropriate sample size, and it may be necessary to sample a larger sample in the winter period to answer with adequate certainty which months would result in the greatest fatality reduction.

Staff Response: CEC staff and consultants have repeatedly commented to WEST that their proposed experimental design to test the effectiveness of winter-time shutdown will not yield sample sizes sufficient to test whether the measure is effective, or whether one half of the winter is more effective than the other half. The sampling design of 2 surveys per treatment will produce too few fatalities to reliably test hypotheses and will not add any more certainty to the existing data. We strongly believe that winter shutdown should be tested, and we request that a statistically robust study design be implemented to reliably test this measure.

Section 4.0 Scientific peer review of research and collaboration

WEST-21: The August 2004 CEC report (Smallwood and Thelander 2004), the primary basis for this Staff Report, and the follow-up staff reports (Smallwood and Spiegel2005a, 2005b, 2005c, Smallwood and Neher 2005), are important in the evaluation of the proposed management measures and should be peer reviewed in that context. This recommendation is consistent with the recent recommendations from the National Wind Coordinating Committee's Wildlife Working Group for research reports.

CEC has published several reports and/or technical memoranda subsequent to the August 2004 CEC report in response to some of the concerns we raised with the report's data analysis (Smallwood 2004, Smallwood and Thelander 2004, Smallwood and Spiegel 2005a, 2005b, and 2005c). We appreciate CEC's efforts to address these concerns. For example, the re-analysis reported in the March CEC report (Smallwood and Spiegel 2005b) addresses a short-coming in the modeling of high risk turbines (see Attachment B). The March CEC report (Smallwood and Spiegel2005a), which was the third of five different efforts to model risk also was an attempt to address concerns we had on the original August 2004 CEC report and the January report (Smallwood and Spiegel2005a). These five reports have not received widespread distribution and will not illustrate to most readers of the 2004 CEC Staff Report that the conclusions reached in the report have changed as a result of additional data analysis.

We strongly support the Alameda County proposed Scientific Review Committee to review the existing scientific research, the proposed management plan, and the implementation of the plan. We recommend that this peer review include access to the basic data necessary to conduct some independent analyses in development of the AMP. We feel these analyses are necessary to explicitly determine, for example, the baseline fatality rates, and to develop sample sizes necessary to create the statistical power to determining the effectiveness of management measures.

Staff Response: WEST, Inc. argues that Smallwood and Thelander (2004), Smallwood and Neher (2005) and Smallwood and Spiegel (2005a,b,c) should be peer reviewed. As explained previously, Smallwood and Thelander (2004) was peer reviewed, and it was also reviewed by the California Department of Fish and Game, the U.S. Fish and Wildlife Service, **by WEST, Inc**. (see Appendix A), and provided to all wind turbine owners for their review prior to release. The staff assessments are not CEC published reports but were provided to the Alameda County working group during what we thought were collaborative and cooperative attempts to develop a viable mitigation plan. WEST had ample opportunity to comment on these reports to the authors, including at several working group meetings, since January. The fact that WEST did not but chose instead to use this forum is in our view a lack of good faith and cooperation.

It should be pointed out that all review comments on WEST's adaptive management plans, provided by members of the Altamont Working Group, largely have been ignored.

In the second paragraph of this section, WEST claims that readers of the Smallwood and Thelander (2004) report will not know that conclusions have since changed due to additional data analysis. This claim is not true. None of the conclusions in Smallwood and Thelander (2004) have changed. Not a single result has changed. On the contrary, additional results have been generated by new analysis.

In the last paragraph of Page 11, WEST, Inc. supports the formation of a scientific review committee that would review the existing research, the proposed management plan and the implementation of the plan. We highly support this and have made repeated recommendations to this effect at the working group and in our assessments. We feel that the management plans produced by WEST for the operators should be reviewed and approved by a scientific review committee before being adopted. We also have recommendations of who should be represented on that committee.

WEST also suggest that this committee should have access to the basic data necessary to conduct independent analysis. We agree and have provided all data as requested. In fact, WEST, Inc. already has possession of the basic data (see Appendix A).

APPENDIX A

Responses of K. Shawn Smallwood, Linda Spiegel and Carl G. Thelander to WEST, Inc. comments and queries over methodology of the avian mortality study in the APWRA.

Linda Spiegel and WEST, Inc. agreed that WEST, Inc. would submit queries to Shawn Smallwood regarding a data set that was provided to WEST, Inc. during spring 2004. These queries would go to data base structure and experimental design and analytical methods used in Smallwood and Thelander (2004).

Note that normal text is text prepared by WEST, Inc., yellow highlighted text indicates statements we identified and responded to specifically, and **Response**, in bold red font, represents responses by Smallwood or by Smallwood and Thelander.

July 7, 2004

Comments on CEC report
Provided by Wally Erickson and Dale Strickland, WEST INC.

We appreciate the opportunity to comment on the report entitled "Developing Methods to Reduce Avian Mortality at the Altamont Pass Wind Resource Area". Please feel free to call us to discuss these comments. Shawn has discussed some of these comments over some recent email exchanges. Hopefully our comments are helpful. We feel that a thorough review of this report by a statistician(s) is important, given the complexity and amount of data. We believe this review is a good starting point to that thorough review, but may fall short given our recent schedules (including vacation time), and the time frame provided for the review.

General

This is an extremely important report, and the PI's should be commended for the amount of data that has been collected, the number of hypotheses that were addressed, and the amount of work that went in to producing this mammoth document. We also acknowledge the importance of a brief executive summary and conclusions chapter that attempts to synthesize an enormous amount of information. Given the size of this document, many readers will probably read only the Executive Summary and Conclusions Chapter. We have already seen some select lines of text taken from your work that we believe are misinterpreted or not put into proper context. The Executive Summary and Conclusions sections, as they are currently written, leave the reader with the idea that most of the conclusions and associations are clearly defined, while the other chapters seem to indicate that most of the results are not so clearly defined. We think it is paramount that enough detail is provided in the Executive Summary and Conclusions so readers do not misinterpret the basis for conclusions. Specifically, there should be a paragraph in the Executive Summary, describing the type of study (mensurative), types of analyses (correlations and associations, not causation) the number of variables considered, many of which are confounded.

Response: On the top of page xxxiii of the Executive Summary, we stated that we used tests for association. That the study is mensurative is unremarkable and warrants no additional mention. Mensurative studies are not necessarily inferior to manipulative studies. Also, it is normal for studies to experience confounding among measured variables, and so there is nothing remarkable about this phenomenon and does not merit a paragraph of discussion in the already lengthy Executive Summary.

We think it is also important to clearly state in the Executive Summary and the Conclusions Chapter that the range of turbines sampled does not represent the typically turbines currently being installed.

Response: We disagree that this is an important statement to make in the Executive Summary or Conclusions chapter. This fact is made clear enough in the report, and one does not have to read very far into it to learn that the wind turbines we studied are relatively old.

Causality

Causality should not be discussed in this document at all, other than that causality cannot be statistically inferred from a mensurative experiment like this one.

Response: We disagree that causality should not be discussed, because this is the point of performing the study in the first place. Also, it is simply not true that causality cannot be inferred statistically from a mensurative study. The purpose of using statistics is to draw inference from the test results about underlying causal relationships. This is why these statistical tests are called *inferential statistics*. Also, it is acceptable and expected that a model should guide the researcher's interpretations in terms of ecological relationships they wish to report or suggest. We feel obligated, and justified, to draw inferences from the model if they appear to us to be consistent with our overall observations, interpretations, and understanding of the ecological relationships at play in the APWRA.

It should be clearly stated that the basis for conclusions etc. is from associations between fatalities, behavior and use with physical, biological and wind turbine characteristics.

Response: See pages 5-6 and 180-184 as examples of clear statements of the tests we used and how we drew conclusions from them.

It should also be clearly stated that there is confounding and correlation among variables and that can affect these apparent univariate assocations. This is discussed in several sections, but should also be discussed in the Executive Summary, and Conclusions Section.

Response: Confounding and inter-variable correlation is common to most if not all research studies involving the measurement of multiple variables. This is widely understood and why reports typically do not make a special effort to discuss these problems in the Executive Summary.

Predictive Modeling

Conducting univariate tests is a reasonable start to developing a list of candidate variables for a "predictive model". The approach to combine results from univariate tests into a scoring system, that does not account for confounding of variables, correlation of variables and interaction of variables is fairly uncommon and is often criticized as data dredging.

Response: The definition of data dredging suggested by WEST is incorrect. Data dredging is the attempt to make too much of the data collected.

The more commonly accepted practice would be to use logistic (presence/absence of fatalities) or poisson regression (counts of fatalities), with the ability to model interactions of factors, treat variables as continuous (for example slope), etc. The influence of a variable could conveniently be portrayed as an odds ratio, and each turbine could be assigned a probability of occurrence of a fatality during a fixed time frame, or an expected number of fatalities in a fixed time frame.

Response: As explained in the report, our fatality data were collected using a differential search effort, which precluded proper use of logistic regression.

This would hopefully provide a better map of the "predicted highly dangerous turbines". In a univariate approach, the results of logistic regression and chi-square would be similar, with logistic regression or poisson regression using the turbine and not the individual fatality or individual bird minute as the unit of replication. Furthermore, with logistic or poisson regression, interactions could be tested.

Response: We disagree. The fundamental problem with whatever test is used is the sample size problem, along with differential search effort. Using logistic regression to identify supposed interaction effects would be an example of data dredging. See page 237.

The authors have said they do not think logistic regression and other types of multivariate analyses are appropriate. You have effectively developed a multivariate predictive model by combining results of univariate tests into a "scoring" or "ranking" system. You would want to limit the number of factors to consider, and number of interactions, but there are likely some very important interactions that should probably be discussed (e.g., topography and canyons). The models you have developed would be more defensible if they were corroborated with more standard approaches. The unequal sampling effort among sampled turbines (set 1, 2 and 3) can be accounted for in these multivariate approaches, using similar approaches to the adjustments you used in your chi-square analyses.

Response: Whether or not these univariate methods can accommodate unequal sampling effort does not matter, because one cannot reliably test interaction effects with small sample sizes, no matter whether logistic regression is used. If we cannot reliably test for interaction effects, then using logistic regression provides us with no advantage over the univariate tests we performed. See page 237.

The omnibus chi-square tests (Tables 7-4 etc) does say anything about what levels of factors are significantly different. It could mean that one level is different than one other level, that a combination of two levels are different than a combination of another two levels etc. This is another reason why fatality rates and the chi-square tests should be portrayed for the factors considered in Chapter 7.

Response: We don't understand what is being suggested here.

The method of "testing" adequacy of model is problematic and should be acknowledged. Testing models with the same data used to build the models will yield an overestimate of model fit.

Response: WEST's comment is misleading because we did not state in the report that we "tested" the adequacy of our simple models. What we said was that we compared actual fatalities to predicted levels of threat in order to assess the effectiveness of the models. This step is pretty simple and straightforward, and yes, it is prone to slight inflation, but we were aware of more significant shortfalls in our models, and so the slight inflation typical of post-hoc comparisons of frequencies was not that important.

Pseudoreplication

There is no discussion of the fact that the chi-square analyses conducted are based on assumptions of statistical independence of the experimental units. The individual fatality (Chapter 6) or minutes of bird use (Chapter 8) are considered the experimental unit in most of the analyses, and not the turbine or turbine string.

Response: This characterization of our study unit is inaccurate. The turbine and the turbine string were central to our study units. Our search effort was quantified per wind turbine, and was factored into chi-square tests accordingly, and used to generate expected values per wind turbine (or turbine string). The observed frequencies of fatalities or bird behaviors at these turbines were then compared to expected values. We recommend that WEST revisit the methods sections of our chapters 7 and 8. Also, we assume WEST made a mistake when it referred to Chapter 6 regarding this matter.

This appears to be an inappropriate experimental and results in "pseudoreplication," resulting an overestimate of the precision of estimates. For the "predictive model" analyses and most individual species, the issue is not that big of a deal, since there are very few turbines that had more than one fatality of an individual species. It is likely a bigger issue for combined groups like all birds and all raptors. That may be why you are seeing so many "significant" differences in those categories (e.g., Table 7-1).

Response: No, it is simply the law of large numbers in action.

The number of turbines sampled is the true sample size, not the individual fatalities or individual minutes of bird use (Table 8-12).

Response: This is not true. Whereas our study unit was indeed the wind turbine in terms of search effort applied, the sample size that really counts is the number of wind turbines with fatalities, or in even simpler terms, the number of fatalities.

We recommend using fatality rates or use rates and tests using the appropriate experimental unit.

Response: We strongly disagree. See our Appendix A. Converting fatality data to mortality is fine for making impact comparisons across large groups of wind turbines or through time, but inappropriate for testing the significance of main and interaction effects of measured variables. When mortality is calculated for a turbine string, the sample size of turbines and accompanying fatalities is much too small and results in many values near or at zero and a few values that are much larger than zero. This is because mortality is an inverse power function of the sampling effort used to generate the mortality estimates, influenced in part by the number of wind turbines in the string. The error terms will be so large that the lower value of the confidence interval is much less than zero, which is absurd. Using these mortality values and their inflated error terms in multivariate tests would be inappropriate, and we just won't do that.

This is likely why there were so many "statistically significant" tests. Many of those tests would likely not be "significant" if the appropriate experimental unit and error term were used. The logistic regression approach or poisson regression approach described above would use the turbine or turbine string as the unit of replication (experimental unit). Furthermore, for some factors such as tower type, rotor diameter, turbine model, fatality rates on a per turbine and per MW basis would likely help the reader have a better understanding of the differences when the fatality data are adjusted by turbine nameplate output. Larger rotor diameters were identified as more risky, but in fact, if you account for output or RSA differences, it will likely go the other way.

Response: We proposed just this pattern in our report (see Appendix A), which is why we incorporated rotor swept area into the search effort term applied to turbine strings (see page 182).

The same might be true for lattice and tubular. You advocate per MW calculations in discussing species and group fatality rates for the overall wind plant, and this should also be addressed in Chapter 7 when discussing differences in fatality rates among turbine types and turbine models.

Response: This suggestion is feasible. We could do this for the wind turbine models that were searched over sufficiently long periods. However, little additional insight would be gained because the chi-square approach we used actually uses more of the information than is used in comparing rates.

Confounding of Variables

There should be a much bigger discussion of the correlation and confounding among the predictor variables. Many of the independent variables are correlated with one another.

Response: This is true of most every field study with multiple measured variables.

Position within a string is likely correlated with slope and steepness and degree of lateral edge. Tower type is somewhat confounded with the canyon variable. For example, apparently there were no lattice turbines in canyons in the first sampling effort, while there were 142 of the 405 tubular tower turbines in canyons the same set.

Response: Not true. There were 19 lattice towers in the first set. But besides the inaccuracy of WEST's numbers, it is irrelevant that the first set of turbines had only 19 lattice towers in canyons because our analysis in this report was based on all the turbines, not just the first set. Including all the turbines, which is what we did, the number of lattice towers in canyons increases to 296.

This should be acknowledged. Could this be a plausible explanation for why tubular are considered worse than lattice?

Response: In an effort to infer interaction effects between canyons and tower type, we split the chi-square tests for association of fatalities with tower type according to whether the towers were inside or outside canyons (see the Table below). Splitting up the data this way resulted in reduced sample sizes and mostly insignificant test results, which demonstrates the effect of the law of large numbers that we discussed previously. Some of the tests should not have been performed because too few expected cell frequencies were greater or equal to 5. Despite the lack of significance in test results in some cases, an examination of the numbers in the table indicate that there may be slight interaction effects for red-tailed hawk, American kestrel, and all raptors combined, indicating slight confounding between variables in the direction suggested by WEST. On the other hand, vertical axis or tubular tower outside of canyons killed disproportionately greater numbers of burrowing owl, mallard, mourning dove, western meadowlark, horned lark, rock dove, and all birds combined. Thus, the suggestion that tower type is confounded with canyon is not compelling; confounding occurred, but varied among species and appeared more often to be strongest in the direction opposite of that suggested by WEST.

We also reported that all of our focal raptor species flew disproportionately closer to tubular towers and disproportionately farther away from lattice towers. These behavior results also contributed to our overall conclusion that tubular towers are no less dangerous to birds than are lattice towers. We made the case that tubular towers on the landscape may appear less busy or dangerous to birds as compared to lattice towers, which may result in birds deciding more often to fly through turbine fields supported by tubular towers. From our split analyses in the table below, it does not appear that canyons factor dramatically into the effect of tower type on fatalities.

Species/Group Tower type	Outside Canyons			Inside Canyons		
	χ^2	Fatalities	Observed ÷ Expected no.	χ^2	Fatalities	Observed ÷ Expected no.
Golden eagle	2.08			1.91		
Vertical axis		0	0.00		0	0.00
Tubular		11	0.95		11	0.86
Lattice		28	1.09		4	1.85

Red-tailed hawk	2.38			4.32		
Vertical axis		3	0.43		0	0.00
Tubular		45	1.03		50	0.91
Lattice		100	1.03		15	1.60
American kestrel	1.30			6.61*		
Vertical axis		1	0.42		0	0.00
Tubular		13	0.88		5	0.65
Lattice		36	1.10		4	3.09
Burrowing owl	34.60**			0.84		
Vertical axis		10	3.93		0	0.00
Tubular		25	1.57		14	1.10
Lattice		19	0.54		1	0.46
Barn owl	4.85^{t}			1.92		
Vertical axis		3	2.19		0	0.00
Tubular		4	0.47		15	0.88
Lattice		22	1.15		5	1.74
Great horned owl	1.31			0.18		
Vertical axis		0	0.00		0	0.00
Tubular		4	0.80		1	1.18
Lattice		13	1.16		0	0.00
Mallard	6.26*			1.14		
Vertical axis		2	2.65		0	0.00
Tubular		8	1.69		16	1.11
Lattice		6	0.57		1	0.41
Mourning dove	4.76^{t}			0.49		
Vertical axis		0	0.00		0	0.00
Tubular		12	1.62		7	0.92
Lattice		13	0.79		2	1.54
Horned lark	5.36^{t}			0.35		
Vertical axis		1	1.01		0	0.00
Tubular		11	1.77		2	1.18
Lattice		9	0.65		0	0.00
Western meadowlark	9.40*			3.08		
Vertical axis		8	2.53		0	0.00
Tubular		23	1.16		28	1.14
Lattice		36	0.82		1	0.24
Rock dove	6.88*			0.24		
Vertical axis		2	0.25		0	0.00
Tubular		61	1.21		21	1.03
Lattice		108	0.96		3	0.87
European starling	1.04			0.15		
Vertical axis		4	1.46		0	0.00
Tubular		19	1.11		8	1.05
Lattice		35	0.92		1	0.77

All birds	9.00*			2.54		
Vertical axis		43	1.01		0	0.00
Tubular		307	1.15		213	0.98
Lattice		551	0.93		42	1.14
All hawks	2.55			3.41		
Vertical axis		4	0.49		0	0.00
Tubular		56	1.09		54	0.92
Lattice		114	1.00		15	1.51
All raptors	1.04			6.26*		
Vertical axis		18	1.00		0	0.00
Tubular		122	1.08		106	0.92
Lattice		242	0.96		29	1.49

Because of confounding, actual effect sizes could be larger (or smaller). Some many other factors could be confounded as well. Based on the maps, there would appear to be confounding among a higher percentage of tubular towers in canyons in the intermediate rodent control area. The areas of no control in the northwest portion of the project area has historically been associated with higher golden eagle mortality (Orloff and Flannery 1992, Hunt 2002) and could also affect interpretation.

Response: And we discuss this in the report. See Appendix B, page 267.

Does it make sense to test some of the important effects within certain subgroups of turbines, to see if the pattern of effects of physical attributes of the locations are consistent. For example, what about looking at the effects of certain variables using only the 56-100 turbines? They are distributed throughout the wind project, and turbine characteristics would not be so confounded.

Response: This could be done, but with a smaller sample size and the associated limitations.

Adjustments in the Chi-Square Analyses

Were adjustments made in the chi-square analyses for search effort of individual turbines, or for search effort as a whole for turbine sample set 1 and set 2 turbines? We believe the Seawest turbines, which are part of your set 1 turbines (?we believe), were added after you started your NREL study as well. Was this differential sampling effort for individual turbine strings specifically accounted for, or was it accounted for more generally (all set 1 turbines adjusted the same, regardless of sampling effort).

Response: Please examine pages 181 to 182. WEST misread or misinterpreted the description of our methods. The search effort applied to wind turbines was tallied per individual turbine, and not grossly across broad groups of turbines considered members of Set 1, Set 2 or so on.

Was the effort (# searches/year or # searchs/6 months) considered the same for all turbines in set 1 and set 2.

Response: See above. Read pages 181-182.

Since there was an increasing interval between searches, was that considered in the development of "predictive models"?

Response: Yes.

Inference

The conclusions and executive summary do not acknowledge the data mining and data dredging aspects of these analyses.

Response: Because we disagree on the definitions of data dredging.

Were all these variables and hypotheses decided upon a priori? With the number of variables and bird groups considered, there are expected to be many "significant associations" that are not real associations would be expected.

Response: We acknowledge this in the report.

If variables were truly independent and pseudoreplication was not an issue, you would expect 10% of the tests to be significant by chance alone, using alpha=0.10. Since pseudoreplication is an issue, you would expect even more tests indicating significant effects by chance alone. Reiterating, we believe you should acknowledge the limits of the study in the executive summary and conclusions including the pseudoreplication issue, the fact the associations do not imply causation, the multiple testing issue, and the confounding of variables.

Response: We will have to disagree on very fundamental issues regarding the use and interpretation of statistical tests, and the standard of reporting of standard analytical shortfalls of studies like this one and every other one. Some level of multicollinearity is inevitable with any study analyzing multiple measured variables, and the same is true with pseudoreplication.

Higher Use near Turbines

Two of the outcomes relate to raptor use and behavior are:

"Inter-specific variation in mortality among species could not be explained by variation in the number of flights within close proximity to wind turbines."

“some bird species spent more time flying within 50 m of wind turbines than expected, and they spent less time within 51-100 m or 101 – 300 m, which indicated that those species were attracted to the areas near the wind turbines.”

Note: the first outcome contains redundant text, inter-specific variation is variation among species.

Response: Noted, and change was made to the text.

It is pretty well known that raptors use slopes along ridges and other topographic features, taking advantage of updrafts, and patterns in flight path data we have gathered at many wind projects prior to turbines being built have supported this. A great example would be a Foote Creek Rim, where we documented much higher use on the upwind site of the rim edge. Do you have data on ridges at Altamont Pass that do not have turbines?

Response: Yes, but they were not used specifically in this study for this report. We might tap them at a later date.

Could some of the “turbine attraction” be based on raptor behavior in association with updrafts? Do you have any flight path data?

Response: We suggested this as a possibility. We noted that raptors may be using the same declivity winds as used by the wind turbine owners in the APWRA.

Is it possible that siting turbines as far to the leeward side of the ridge as possible might reduce mortality? We recommend this is discussed.

Response: It is possible, but this is purely speculation. Our recommendations are based on empirically founded patterns described in our report.

Rock Piles

There are several conclusions drawn that do not appear to be supported by the data. For example, presence of rock piles are said to increase fatalities in some areas of the APWRA although the univariate tests (Table 7-1) are not significant for the 4 target species (BUOW, AMKE, RTHA and GOEA). The only group that is significant is for all birds as a group, and as pointed out above, pseudoreplication caused by treating each fatality as an independent observation is a large problem with the all bird analyses. Based on more recent conversations with the authors we understand that there was an apparent relationship with rock piles in the earlier NREL study. Some discussion of this would be important so people understand why it was not shown in the larger sample of turbines and why the effect “went away” when data were pooled.

Response: See page 210 of the report.

We recommend putting in a map of rock piles (at least string categories), like you have done for other variables. An explanation supported by data would be helpful so people understand why this particular effect (rock piles) was only observed in the earlier NREL study and not when data were pooled. We do not believe it is sufficient to say it is because it only occurred at the turbines initially studied. What is the "biological" reason for this inconsistency.

Response: The biological reason for this "inconsistency" is that the effect of artificial rock piles will occur where rock piles occur, but not where they don't occur. For example, we cannot detect a canyon effect at turbines only outside of canyons. As you increase the sample size of turbines with fatalities outside areas where artificial rock piles occur, then you dampen the effect that can be detected in the subsequent test.

It would also appear to be the case with canyons. Some initial analyses we conducted of the effects of canyons are not as obvious in the 3rd sampling effort (set 2 turbines), based on some analyses we conducted.

Response: We cannot comment on any analysis WEST conducted on our data set because we cannot know whether WEST factored in sampling effort, or whether WEST used the same standards that we did in deciding whether the sample sizes warranted a statistical test.

This is not intuitive. The variable definition is somewhat arbitrary. We do acknowledge longer sampling at the 700-1500 turbines sampled in set 1. But 6 months of sampling at 2500 turbines is a big effort (similar effort to 400 turbines sampled for three years). One would hope that patterns observed in the first sample set were also observed in the 2nd and 3rd sample set.

Response: The sets of turbines compared are from different parts of the APWRA. WEST was just alleging that we pseudoreplicated our experiment and statistical tests, and then claims that the same patterns ought to be detected between sets of turbines from different locations in the APWRA. We obviously disagree.

The outcome regarding canyon effects appears to be supported by most of the data. A clear definition of a canyon turbine should be identified. The effect may be larger or smaller when considering confounding effects such as tower type. No lattice towers were located in "canyons" at the turbines sampled for the longest period (Group 1) (see confounding above).

Response: This is incorrect. See above.

We do not believe there is an association with canyons when you only look at the Group 3 data (2500 turbines x 6 months = 1200 turbine years of effort). Is there an explanation for this? We recommend that this be discussed.

Response: Yes, the Group 3 turbines were located in a different part of the APWRA and were sampled for a much shorter time. Sample sizes per species are smaller than at Groups 1 and 2, and so small that we might not test for a canyon effect with this subset of the data considered alone.

We did not test for associations within each group of wind turbines. But to address WEST's suspicion that there may be no canyon effect in group 3 data, we went ahead and tested for canyon effect among wind turbines in Group 3. Sample sizes were adequate for performing chi-square tests only for two species, red-tailed hawk and barn owl. Turbines in canyons killed red-tailed hawks 2.6 times more often than expected by chance ($P < 0.005$), barn owls 3 times more often than expected by chance ($P < 0.01$), all raptors 1.7 times more often than expected by chance ($P < 0.005$), and all birds 1.3 times more often than expected by chance ($P < 0.05$).

Appendix A

The discussion of how search effort and fatalities/turbine/year or fatalities/MW/year is not easily understood and we believe will be miss-interpreted. We agree that the rate of a particular turbine string may not be stable after one year, but average rates of more than one turbine string would stabilize sooner than 3 years.

Response: We demonstrated with our data that the average rate derived from more than one turbine string definitely did not stabilize before 3 years.

If interest is in an average fatality rate for a wind project, and not an individual turbine string, rates would stabilize sooner.

Response: This conclusion is wrong, as demonstrated by Figure 6 in Appendix A.

Several turbine models are nearly identical in tower height, as well as in other turbine characteristics, although there are great differences in effects. Any explanation? To get a more general relationship, does it make sense to combine similar turbine models

Response: We would need more information to interpret this comment and to respond.

Only ~500 fatalities out of ~1100 "wind turbine fatalities" were listed on page 25. Are the remaining unknowns?

Response: On page 23, where we reference the Figure on page 25, we stated the following: "However, many of the carcasses showed signs of multiple injuries, and these are not represented in Figure 2-3."

Were there any trials done to test the "days since death" estimates. We believe estimation of time of death can be pretty problematic.

Response: Whether we estimated a bird's death at 22 days, but it died 35 days before, or whether we estimated a bird's death at 300 days ago, but it died at 400 days ago, really is not very important. Such errors would have made little difference to our mortality estimates and absolutely none to our fatality associations.

Standardization by Effort

Several graphs display the total number of fatalities by levels of factors. For example, winter and summer are described as being the periods of highest fatalities, and a reference is given (Figure 2-5). We recommend standardizing the data by effort for seasonal comparisons. We believe winter may have been sampled with more effort, since the last sampling effort (2500 turbines) occurred during primarily the winter (November 2002 – April 2003). Figure 2-6 might be interpreted to indicate a certain model is more risky. We believe strongly that fatality rates should be graphed, not total numbers, or have at least both.

Response: We strongly disagree, because such a graph does not inform the viewer of sampling effort, and can therefore easily mislead the viewer.

We recommend more detail on your conclusions that Altamont Pass is not an anomaly. We believe your basis for this is that raptor fatalities compared to your estimates of raptor use was not very different than other wind sites.

Response: Correct, so from that perspective it is not an anomaly.

Our analysis appears to suggest an anomaly or uniqueness of some sort. Where in the report do you show these relationships?

Response: in Chapter 4.

Our comparisons suggest 2-4 times the use and 10-20 times the fatalities when compared to Foote Creek Rim, Buffalo Ridge, and Stateline wind plants. The largest per MW rate using the more intensive fatality methods that we have used (searches more frequently and adjustments for scavenging and searcher efficiency) is around 0.10 raptor fatalities per turbine per year, while your unadjusted estimates appear to be 1 raptor/MW/year.

Response: We need more information to address this comment. We do no understand the point being made.

Furthermore, if you included TUVU in your use estimates, use differences would be inflated even more between APWRA and other areas, since TUVU use is high at the APWRA

.

We think you would agree that fatality data for “all birds combined” are not very comparable to other studies, due to the high uncertainty from wide search intervals and scavenging and searcher efficiency biases.

Response: No, we disagree.

We wonder if the methods used previously for documenting use in the APWRA (Orloff and Flannery 1992, 1996) were the same methods that you used. When you documented interactions of turbines and birds in your behavior studies, were you focused on a 360 degree area around the observer, or were observers focused on a smaller more focused area in front of the observer. This would be important in describing use including changes from your studies to the previous studies.

Response: We and Orloff and Flannery explained our methods. We did use 360 degrees.

Make clear the adjusted fatality estimates reported in executive summary and conclusions is based primarily on experimental bias studies in Oregon and Washington.

Response: Referencing other studies is not typically done in an Executive Summary.

Conflicting Results

Some results, on face value, seem to conflict with each other. It is stated that repowering with the tallest of towers should reduce mortality, but in the first bullet, it is suggested that turbines on taller towers are worse. Most people reading this would think those two results conflict with one another.

Response: The tallest towers in our study are shorter than the towers proposed for repowering.

Also, is the outcome that most flights occur below rotor plane of new generation turbines for all birds, raptors, all diurnal birds etc. What about nocturnal migrants and bats?. Most of our data on flight altitudes at other wind projects put a large percentage of raptors in the rotor plane. The difference could be behavior.

Response: True, we focused mostly on raptors when recommending that taller towers be used. Other species might get killed more often, such as gulls. We did not address bats, since our study was focused on birds.

KVS-33 turbines are discussed as some of the most dangerous turbines in the Executive Summary, but this is not mentioned in Table 7-4 except for one case (AMKE). Does not seem like a strong statistical basis for such a strong statement?

Response: We contend that associations with turbine attributes tell more of the story than do the associations with turbine model. The KVS-33 turbine has the largest rotor diameter, for example, and shows up repeatedly for species further down Table 7-4 from the associations with turbine model.

It should be noted that the KVS-33 fatality rate appears to be approximately twice as high for AMKE compared to 56-100, but the nameplate MW is 4 times higher, suggesting the per MW fatality rate is one-half that of 56-100. Replacing 4 56-100's with 1 KVS-33 would reduce mortality by 50% based on your data for AMKE. This was the only species where KVS-33 were listed in Table 7-4, so it would appear the fatality rates for these turbines would likely be quite a bit lower than the other smaller turbines for most other bird groups. This is another good example of why the data should be portrayed in Chapter 7 and in other chapters in terms of fatality rates by turbine type etc. It is easier to understand than "the accountability mortality %" for most readers.

Response: Fatality rates may be easier for some to understand, but they are inappropriate in cases of uneven sampling effort due to an inverse power function between the rates and the sampling effort used to estimate those rates.

Relocation and Shutting Down Turbines

Page 237, end of page. For golden eagles, red-tailed hawks and American kestrels, it was stated that elimination of most turbines may be the only way to "substantially reduce mortality". What is the definition of a substantial reduction in mortality, and is this considering all management measures, or only relocation?

Response: We repaired this sentence for another reviewer.

What about repowering, what about other factors such as painting, and range management that have not been tested. What if effects are not additive, what about interactions?

Response: We agree that there are a lot of 'what if's?' But we still believe that measures should be taken to reduce mortality to the extent feasible. Measures with greater uncertainty of their effectiveness should also be monitored, so that we can make changes as needed.

****

The following is an email exchange that followed a phone conversation. In this case, Smallwood's response follows the phone conversation, and Wally Erickson's email response reiterates what he said on the phone. First, we present Erickson's email response, then Smallwood's response to the phone conversation.

From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Friday, June 25, 2004 3:01 PM
To: Shawn Smallwood
Subject: RE: Conference Call

Shawn,
…

I do not in general disagree with the idea of keeping it simple. We have often been criticized for keeping it too simple, but the old saying, "you can't make chicken salad out of chicken shit" is applicable in a lot of cases when multivariate complex analyses were used instead of simple tests. I do agree with your statements regarding the statistical test used is less of an issue, and experimental design is more important. I do believe there are dependent data issues and pseudoreplication issues to varying degrees in the chi-square univariate analyses when individual fatalities or individual bird use units (minutes for example) are the basis for sample size (possible overdisperson). I also believe that both the chi-square analyses and the fatality rate approach have issues with unequal sampling effort, and a similar approach you used for dealing with unequal sampling effort in the chi-square analyses could also be used in fatality rate calculations. The nice thing about fatality rate calculations is that the pseudoreplication issue described above for the chi-square analyses would be less of an issue (use string or turbine as experimental unit, and not individual fatality or individual bird use unit).

We can talk more about the use of logistic regression. I see it as a more standard way of coming up with a "predictive model". You have, in effect, developed a multivariate predictive model combining the results of univariate tests, with the same issues regarding confounding and correlation you would have with a logistic regression or poisson regression model and less of an issue with pseudoreplication. One approach we have used mensurative studies like these is to try a couple of different approaches and if they lead to the same answer, we tend to feel a little bit better. If they do not, it is important to understand why. I also think that maybe a few important interactions might be interesting to look at, such as canyons and some of the other topographical elements or turbine characteristics. Just a thought. I would be very interested in trying some of that sort of thing, and use some of the interesting AIC and modeling averaging approaches to variable selection. Let me know if you are interested in collaborating in that sort of thing.

At 12:49 PM 6/25/2004 -0700, you wrote:

Response:

Dear Wally,

I enclosed a couple of papers I authored on the topic of ecological pattern analysis. The paper entitled "Understanding ecological pattern and process by association and order" (I've come to regret this title) is the principal paper on the topic, and the one that I think best represents my thinking on the use of chi-square analysis, as well as issues of experimental design. The appendix, especially, explains my philosophy on experimental design and the use of statistics in hypothesis testing.

Both papers were scanned, and the scans were imperfect, so I apologize for the glitches. The second paper on habitat analysis also addresses experimental design and statistical interpretation, but less so than the other paper.

If you go back and look at Karl Pearson's (1904, 1911) and Yule's (1900) work on the chi-square test, you will see the mathematical derivation of correlation analysis from chi-square analysis. Ultimately, regression analysis is also derived from chi-square analysis. Test assumptions between correlation and association analysis are similar, but there are also differences, partly due to a difference in world-view that emerged with the rise of population genetics. I think the conflict of world-views was never resolved adequately, and has resulted in a lot of confusion over the appropriateness of statistical tests for the situation, as well as over interpretation of the test results.

Most significantly, though, the specific statistical test used for hypothesis testing is less important than is the soundness of the experimental design and consideration of the Central Limit Theorem. In the face of having a small sample size, I believe it is most appropriate to rely on the simplest statistical test(s) available. The level of inference one draws from the hypothesis test should depend on the degrees to which the experimental treatments are replicated, interspersed, and measured at the appropriate scales.

Our sample size is relatively small (not to trivialize bird mortality in the APWRA, however), though it is larger than gathered at any other wind farm. The number of fatalities recorded within the time-spans of our monitoring thus far is too few to tease out shared variation between or among independent variables, no matter what statistical tests are used. Given the constraints of the experimental design(s) imposed on analysts of wind farm fatality data, as well as the small numbers of fatalities per treatment, multivariate testing is folly. Sure, one could perform multivariate tests, and one could generate results with interaction terms, etc., but being able to do so does not mean it is appropriate.

Converting fatalities to rates, i.e., mortalities, does not get the analyst around the problems just described. It also adds the additional problem of relying on many mortality estimates that misrepresent true mortalities simply because the wind turbine strings were not searched over long enough time spans to record fatalities. In the APWRA it takes three years before an asymptote is reached in the percentage of turbine strings at which fatalities are recorded (ca. 95%). In other words, sampling effort makes a huge difference in arriving at associations or correlations in our case, but converting fatalities to mortalities (rates) artificially removes sampling effort as a contributing factor to the results. Ignoring the contribution of sampling effort, when sampling effort varied among turbine strings, can result in apparent relationships that are spurious, and all the more so as a greater number of briefly-searched turbine strings are included in the analysis.

I hope this note and the attached papers serve to explain some of my reasoning behind my decisions of how to analyze bird fatality data, as well as my recommendations for a mitigation plan, though the latter would need some additional explanation, which I can go into some other time.
****

From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Monday, August 30, 2004 5:48 AM
To: Shawn Smallwood
Subject: shape files

Shawn,

Is there any chance (Linda told me to contact you) you can send me a corrected version of the shape files and dbase files that you had previously given to CEC with attributes and summary fatality info (predicted risk, fatalities for 4 focal species). This would greatly increase our ability to incorporate your CEC study into the plans. This has been a major obstacle.

Response of 8/30/2004: Wally, Corrected version? What does that mean?

From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Monday, August 30, 2004 8:24 AM
To: Shawn Smallwood
Subject: RE: shape files

Shawn,

The version I received apparently had some data fields that were not accurate. For example the file I received did not have any lattice towers in canyons in the set 1 turbines (turbines sampled the longest), but you said in your response to my comments there were 19.

Response of 8/30/2004: Wally, I don't think your count of lattice towers in canyons was affected by any flaw in the data you received. I think it is a data set familiarity issue. I am very familiar with the data, and you are not. It would be like me obtaining and trying to analyze some large data set you put together; I would likely end up with discrepant results from yours.

I am surprised you are asking me to send you the data again, since Linda Spiegel made it clear that we are not going to share these data sets at this time. Please refer back to your correspondence with her.

From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Monday, August 30, 2004 9:10 AM
To: Shawn Smallwood
Subject: RE: shape files

Shawn,

Linda told Dale to ask you for the information. I am not asking for the raw data, only a summary set that we can use to select sample sites etc.
Response: Let's wait for Linda to return, and you can ask her. A shapefile would include the raw data. I am not sure what you mean by a "summary set."
Not to reanalyze. I understand your concerns regarding discrepancy in results. Can you please at least identify the 19 lattice towers that were sampled in set 1 that were located in Canyons.
Response: I don't know which towers you missed. I can guess though. I wouldn't be surprised if they were the Windmatic turbines (we called them Holocombs) just south of the SeaWest office.
Can you provide me with a turbine list (using your id's) that show the ones predicted high risk for each focal species, or can I assume the file I have is correct.
Response: I don't know why the file you have could be assumed to be anything but correct, unless someone changed the data between when I handed that data set off to the CEC and now.

>>> Dale Strickland <dstrickland@west-inc.com> 08/30/04 10:40AM >>>

Linda,

I am more than a little confused by Shawn's response to Wally's request. It is my understanding that we can not receive the entire data base from Shawn. We agree with this limitation and have never expected we would be given the entire data base. However, you did say that we could make specific requests for data reports, which Wally has made. Just before you left for your vacation you told me that we should submit our request directly to Shawn, which Wally did.

Please clarify what we need to do to receive data reports from CEC. Please understand that we are simply trying to use the existing information to do as good a job as possilbe in designing and conducting the work expected of the companies operating in the APWRA by the US Fish and Wildlife Service. It is my assumption that you also want any further work done by the companies to be done professionally and that it build on existing information, including the work already completed by CEC. It is my understanding that this is a collaborative effort involving the companies, CEC (including

Shawn as your consultant), WEST, BioResources, and the US
Fish and Wildlife Service.

Response of Linda Spiegel on 9/1/2004:

Dale:
I'm sorry there has been trouble with data transfer while I was absent. I spoke with Shawn and he does not understand exactly what information Wally is requesting in some of his emails. We are still not willing to give you the entire data set and do not understand what you want in a "summary set". Please be more specific and I will try to get you a quick response.
Thanks
Linda
****

Response to query made by Erickson at a meeting: Wally, At the G3 Energy meeting in Tracy the other day, you showed me an inconsistency between maps in the CEC final report and the one I produced for the proposed alternative mitigation plan. I spent some time tracking down the source of that inconsistency, and finally found it. There is no inconsistency, really. You need to read the first two sentences of the last paragraph of the methods section in the Alternative Plan to Implement Mitigation Measures in APWRA. These sentences explain the screening that I did prior to summing. What these sentences omitted, however, was my setting all these screened turbines to zero values in the summation of relative threat values among the 4 focal species. I could have been more clear.

Hope this helps,

Shawn
****

Response to phone query, 9/3/2004: Wally, The following are answers to this morning's questions.

The Seawest turbines were added to our search rotations between December 2000 and February 2001.

The variable rthamort was one of those display variables that was not used for analytical purposes. When rthamort was created, I decided not to calculate mortality for any strings with search durations of less or equal to one year, so string 106 was excluded for this reason and now you see missing values. However, the CEC analysis of mortality did include strings searched less or equal to a year, partly because I wanted to identify relationships between mortality estimates and the search durations used to make the mortality estimates. Therefore, the analytical data base fields representing mortality do not include missing values for red-tailed hawk mortality at string 106. In case you are still wondering, though, we did not find any red-tailed hawk fatalities at string 106.

Shawn
****

Date: September 16, 2004
To: Wally Erickson
Fr: Linda Spiegel, Shawn Smallwood
Re: Specific Data Requests

Following your questions and data requests are our responses.

1. The file you had sent to CEC is missing data for the MORTRTHA field for one string. Could you provide that data?

Response: Yes. We will send you the data to fill the gap in the field, MORTRTHA.

2. Can you provide the various attributes for each turbine that were used in the various models of predicted risk? This information will be useful in isolating the important factors at each turbine contributing to high or low risk and help determine which management measures to focus on. Most of the attributes are in the file we have received, but I believe some of the attributes are missing. For example, the values for count_300 and elevation are missing in the previous shape file. Another important attribute would be position within a string (1st from end, 2nd from end, 3rd from end), so we can isolate the turbines you have identified as ones most worthy of relocation consideration.

Response: Yes. We will provide you with these fields.

3. Is it possible to get the date of the first search, date of last search, and number of searches at each turbine

Response: As we already stated during past conversations, we believe it is inappropriate to convert our fatality data to mortality estimates in the manner you said you intended, so we cannot provide you with these data. We disagree with your stated intention to convert these data to mortality estimates at the turbine string or individual turbine level, including turbines where fatality searches were performed less than one year.

4. Can you provide locations of the bird behavior stations?

Response: Please explain why you need to know these locations. Specify how will this data be used?

5. Our appendices in our reports show each fatality, including when it occurred and at what turbine/structure. I have not found that information in the reports. Can you provide that to me?

Response: As we discussed during previous conversations, the fatality data cannot be used in the manner you stated you intended and the results would be misleading. Therefore, we cannot provide these data.

On 9/24/2004:

Wally,

I attached the data file with the wind turbine attributes you requested. Also included is the data repair under the field 'RTHAMORT'. However, I should tell you that the fields you already had representing count_300 and elevation were the fields I used for model predictions. These fields were categorical and were named cnt300cat and altcat. Hope this helps.

Shawn
****

From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Tuesday, September 28, 2004 8:25 AM
To: Linda Spiegel; Shawn Smallwood
Subject: bird behavior locations

Linda and Shawn,

We recently requested the locations of the bird behavior stations that were used during the NREL and CEC studies. You responded by asking why we want the locations. I believe one of the developers also commented that those locations be included in the CEC report, and your response was that you would include them if you had time. I believe you did not include them
In the report.

We would like the locations so that the avian use and behavior studies for the management program can utilize these locations and best make use of pre-management information and control for spatial variation. Please let me know as soon as possible whether you will provide the locations?

Thanks,

Wally Erickson

Response of 10/4/2004: Wally, I will get you the locations of the CEC behavior observation points (OPs). There is a little more legwork I need to do in order to get these, but when I do, they will be sent to you forthwith.

Furthermore, Linda and I will be working with Karin Sinclair to obtain the OPs for the NREL study. I'll get you these, also, as soon as we get access to them.

Shawn
****

11/15/2004

Shawn,

Can you provide me with a working definition of what is a ridgetop versus a ridgecrest?

Wally Erickson

Response provided by phone.
****
11/16/2004

Shawn,

Any clarity on mortality estimates in Table 3.11.

Wally Erickson

No Response because query was too vague.
****
11/18/2004

Any headway on my question regarding the mortality estimates in Table 3.11.

Wally

Response on 11/21/2004:
Wally, I was under the impression you were asking me about the mortality estimates in Table 3.11 for your own, unstated personal reasons. Now it appears your query involves Linda Spiegel and the CEC, and I am under some sort of time pressure to respond to you. Being that your question was made in the context of the agreement between WEST and the CEC (which I did not realize when you asked me the question over the phone), could you clarify for me why you need the answer to your question? How would my time and effort investigating Table 3.11 assist with the preparation of your adaptive management plan?

Next time you ask me a question about the CEC final report, please make it clear the purpose and context of your question.
Thanks,
Shawn

On 11/22/2004, Wally Erickson wrote: When I talked to Linda last, I brought up some issues with applying the CEC model without considering things like size of turbine, etc. She recommended that we talk about these and other issues at the originally scheduled meeting (the one originally scheduled for last week). The issues I had with Table 3.11 originally stemmed from our BV EIR writeup, but also have some effect on monitoring in the Adaptive Management Plan. If we set some trigger for reduction of mortality, and the trigger is based on Table 3.11, I would like to make sure the numbers are clear. That is how this relates to the Adaptive Management Plan. That Table is being used in a lot of EIR's EIS's etc. when discussing impacts in the Altamont. If you have any additional questions, let me know.

Wally

And again on 11/22/2004: Rather than back and forth emails with tit for tat explanations that Linda and others probably cannot understand, I suggest we talk about these issues face to face with Linda present. I think it is very important for her and others to understand what we both are trying to say. Verbage like "because of the law of large numbers" is probably not well understood by most.

Trust me. I know the mortality estimates are not incorporated into the model. I was trying to tell you that Linda thought this mortality question as well as the issue I have with the model (penalizing larger turbines using a per turbine basis for fatalities rather than using a per MW basis) should be topics for discussion at our meeting face-to-face rather than through these condescending emails that most do not understand. I am really sick and tired of them. Hopefully we can get beyond this.

Response of 11/22/2004: I favor a cessation of this email discussion, but I will remind you that you initiated it. I felt manipulated by your asking me a "by the way" question over the phone, and then copying the same query to Linda via email, and in so doing giving the impression that I was tardy in replying to you in an official context. Please try to keep your queries clearly separated and consistent between jobs: Buena Vista EIR versus adaptive management plan versus independent collaboration, if there ever is such. This will avoid misperceptions and conflict in the future.

I'm sorry if my email appeared to you to be condescending, though I am not sure how it was so. You asked a question and I answered it. I identified to you the role of the law of large numbers because it is central to my answer. If Linda did not understand it, and she wanted
to know what I meant by it, I have no doubt that she will ask me about it. However, I don't assume Linda is oblivious to the law of large numbers; she is a trained scientist with her own publication record and a long career in science. That stated, I am done with this issue unless and until you want to discuss it in person.

Shawn
****

From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Monday, December 06, 2004 10:49 AM
To: Linda Spiegel; Shawn Smallwood
Subject: raptor use stations

Linda and Shawn,

Hope things are well. We can discuss the Wildlife Working Group meeting last Friday when we have some time. I thought I would check to see status of the data request I had involving the locations of the raptor behavior stations. Also, I would still like to talk to both of you regarding Table 3.11 (fatality estimates). I want to make sure I know what the best metric (#/MY/year) and the best value of that metric (Table 3.11, individual species estimates unadjusted, adjusted for search detection, adjusted for search detection and scavenging) will be for comparing pre-repowering and pre-relocation/decommissioning to the estimates for repowered projects and estimates after relocation/decomissioning. We should try and setup a time this week to talk about that. Talk to ya soon.

Response of 12/8/2004: Wally, the observation points for the behavior work are attached as a shapefile. Note that some of these points are nearby each other. Different sides of prominent hills were sometimes used to observe different portions of the study area.

Shawn
****
From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Wednesday, December 08, 2004 8:20 AM
To: Shawn Smallwood
Cc: Linda Spiegel
Subject: RE: data forms or fields to characterize unsampled turbines

We are using Trimble Geo-XT, which has submeter accuracy. … We will be trying to get the data dictionary built for the XT, but we could also try and rent the Pathfinder Pro's instead.

Do you have a list of all the variables they recorded?

Response of 12/8/2004: I attached the Pathfinder data dictionary we last used on the wind turbines. If the Turbine Type field does not include a turbine model that fits what you see in the field, you have two options. One, you can modify the data dictionary now before it is used on this project, but I recommend not modifying it after you begin the job. Or two, you can select 'unknown' from the menu and type in the turbine type under the Notes field. After you collect all the data, you can then edit the data set at will. I can help you do this if you haven't done it before.

Shawn

On 1/5/2005 Wally Erickson wrote:

Is it possible to get the data dictionaries used for the avian use surveys and the fatality surveys for the previous work? This would help in setting up the field studies for the management measures and repowering.

Regards,

Wally Erickson

Response: Data dictionary was provided, but not used by WEST, Inc.
****

From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Wednesday, January 05, 2005 4:18 PM
To: Shawn Smallwood
Subject: new report

Just got your new report of the GIS analysis with behavior. Looks good. Quick question. Is each observation used in the analysis each plotted point of a raptor, or each flight path of a raptor? If the same raptor was plotted twice (in viewshed for a minute), was it counted twice.

Response of 2/6/2005: A raptor plotted twice was indeed counted twice. If it was in view for 9 minutes, it was counted 10 times.
****

From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Friday, January 28, 2005 8:45 AM
To: Shawn Smallwood; Linda Spiegel
Subject: data file for Tier 1 thru Tier 5

Shawn and Linda,

I am sure both of you are very busy and sorry to keep bothering you. I have left some phone messages with Shawn, but he must not have been available earlier this week. Can you send me the data file I requested previously that shows the 4074 turbines, the model attributes, fatalities, and new modeled values. It would be helpful to get the individual new predicted risk values for each species and then the final risk categorization Tier 1, Tier 2, Tier 3, Tier 4 and Tier 5. I would also prefer to have the number of searches and dates of searches as well, but I no you have not been comfortable in the past in providing that. Is there a format that information could be provided that would allow me to effectively use the information (e.g., sampling effort weights). I believe the information (search intervals, number of searches) will be helpful in determining where to sample and what the baseline fatality rates will be at the turbines selected to monitor to compare to the rates after monitoring.

I need the new risk model info so I can get the information to companies about what Tier 1 through Tier 5 turbines belong to each company, and I believe having this information will allow us to get a quick read on approximately how many of the uncharacterized turbines will be considered high risk. Since most of the uncharacterized turbines are Kenetech 56-100's in areas where you have characterized risk in the surrounding areas, and the turbines in the surrounding areas have generally been considered lower risk, I do not believe many of the new turbines will be included in the T1 and T2 turbines high risk categories, but will not know until the turbines are characterized.

Response of 1/31/2005: I attached a shapefile with the information we agreed to give you. The field named 'Tier10' is the one you'll want.

I hope it helps
****
From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Monday, January 31, 2005 6:20 AM
To: Shawn Smallwood
Cc: Linda Spiegel
Subject: Wednesday

Shawn,

Hope things are well. Are you available today or tomorrow to discuss the status of our work together, including the risk characterization for the 1085 turbines yet to be modeled, and how, if necessary, turbine size differences (nameplate MW) might be accounted for in the models? If Linda is available, we could all get together on the phone. I could also be available in Sacramento on Wednesday for lunch (11:30-1:00 pm). Also, just a quick reminder. I really need the data showing the new risk values for the 4074 turbines per my previous emails.

Regards,
Wally Erickson

Response of 1/31/2005: My schedule can't get any fuller than it is right now, and it will be this way for some weeks to come. At this point I think it will be more productive to send us emails explaining why and how you propose to factor turbine output capacity into the tiering of turbines for selective shutdown or relocation. Some of your phone messages were garbled due to poor connection, so I couldn't hear why you thought turbine size should be factored in, and how you proposed to do it. (I hope it is not deaths/MW/year, because that won't work.) I also think it is more efficient to see these thoughts written out rather than to track phone conversations and phone messages. Anyway, I'm open to seeing your ideas about how and why we should factor in turbine output capacity.

Thanks,

Shawn

From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Tuesday, February 08, 2005 7:31 AM

To: Linda Spiegel; Shawn Smallwood
Subject: Baseline Fatality RatesLinda and Shawn,

For WEST to efficiently move forward regarding the Adaptive Management Plan, we need to get more detailed information regarding when each turbine was searched during your study. That information will be extremely vital in establishing the best design to use for the monitoring program, and to a priori establish how we will measure the effectiveness of the program. Shawn, your concern previously was that I was going to "calculate" fatality rates instead of the chi-square tests. If we use different search intervals that you did (mean=53 days for first sampling set, mean=90 days for 2nd sampling set), we need to somehow account for this in the analysis. We are setting things up to fail if we do not appropriately deal with this. Doing searches on a 30 day basis, and comparing observed fatality rates to rates calculated using some other search protocol could lead to severe biases if not addressed. I want to address this in the plan.

If it looks like you are unable to meet this request, I need to know right away so I can right something in the AMP to address the issue.

Regards,
Wally Erickson

Response of 2/10/2005: Shawn explained to you our concerns about converting fatality data to mortality estimates at the levels of the wind turbine or turbine string without accounting for the differences in search effort. Your request for the data again reiterates your intention to calculate mortality estimates at the individual turbine level, and we disagree with that approach.

Not having that search effort information will not set the plan up for failure. To assess whether an adaptive management plan goal has been met after three years, you need an APWRA-wide point estimate of mortality, not estimates of mortality at individual wind turbines. Therefore, you have all the information you need to proceed with an adaptive management plan.

The differences in search interval can be adjusted. In fact, WEST has made these adjustments on other projects (e.g. stateline, Tehachapi) Therefore, we do not believe that doing searches on a 30 day basis, and comparing observed fatality rates to rates calculated using some other search protocol will lead to severe biases. You should factor in scavenging rates to your mortality estimate based on the data you collect and based on your 30-day search interval. Factoring in scavenging rates thusly will allow a reasonably reliable comparison between mortality during the next three-year period and mortality during the previous five-year period.

Again, we feel that you have what you need in Chapter 3 of the CEC report.

I spoke with Steve Steinhour yesterday. Shawn will be exploring the question of the number of MW needed to be shut down to accomplish an acceptable reduction in fatalities. He hopes to have something completed by the 24th.

Linda

On 2/11/2005, Wally Erickson wrote: Linda and Shawn,

Attached is a brief technical note on the turbine size and risk modeling issues I have mentioned to you over the past months for your consideration. Hopefully this illustrates how important it is to address this issue. I really hope that Shawn will collaborate with me on the risk modeling or get an independent quantitative peer review before a new model is released. I do believe that truly working together on this will avoid some of the conflicts and concerns that continue to exist.

Response: Complete re-analysis of the fatality associations in Smallwood and Thelander (2004) and presentation of the results in Smallwood and Spiegel (2005b).
****

Linda and Shawn,

Good morning. Another of our many requests. I believe I requested this from Shawn in the past, but I may have referred to the wrong Figure number. Could you please identify the study sites and study references for the data points in Figure 4-2? This figure is a component of your mitigation formula's. You have several citations on Page 77 to the studies you used (14 I believe) but I would like to know which 10 out of the 14 you used, and which data points correspond to which study.

Response unknown.
****

Shawn and Carl,

Hope things are well. What are you recommending for diurnal avian use surveys for proposed and existing wind energy projects. Are you using one or two observers per station. I believe you used 2 observers at Altamont. In studies in the Altamont, should we be using 1 or 2 observers? Most other avian use studies have used one observer. Interested in getting your thoughts. I copied Linda and Karin as well to get their thoughts.

Response of 3/9/2005 by Carl G. Thelander: It's in our report(s).

>>> Wallace Erickson <werickson@west-inc.com> 3/9/2005 3:37:16 PM >>>
Just trying to get quick clarification without going back to the 600 page report. By your response, you obviously do not want to provide a quick response. Thanks for all the help.

Response of Linda Spiegel on 3/9/2005: The Behavior work is covered in Chapter 8. Under methods it states that 2 were used. I think both Carl and Shawn are reluctant to provide much help, particularly on a fairly easy to get answer (it only took me a minute), because you are trying to discredit the analyses and use the data set in ways they feel are inappropriate. It is also a professional courtesy not to take another professional's data set until publications are finished.

You can't attack their science to further your client's objectives and take their data against their will and expect them to feel inclined to help with this type of question.
I will try to answer when I can.
****

>>> Wallace Erickson <werickson@west-inc.com> 04/06/05 10:07 AM >>>
Linda,

We greatly appreciate the data you sent us regarding the search dates, turbine characteristics and fatality locations for the CEC study. As a followup, I have a few additional requests.

NREL Data

Can you provide the data you used in the August CEC Report that was collected during the NREL study (data prior to November 2001)? It looks like providing that data in the same format as you provided the CEC data would suffice (same formats as those in files "CEC data_fatalities.sav", "CEC data_search dates.xls", "CEC data_turbine attributes.sav"). Let us know if we also need to contact NREL for this latest request.

Response: CEC has no authority to release data collected under the NREL contract with BRC.

Modeling Results

Could you send us dbase and shape files (or SPPS files) that contain the results of the latest modeling effort you recently released in the report "Partial Re-assessment Of An Adaptive Management Plan For The APWRA: Accounting For Turbine Size". It would be extremely helpful if you could provide the predicted risk values for each of the 4 focal species for the models developed in the January 2005 report, and the final tier values (1-5) as well as the risk scores for each of the 4 focal species for the March 2005 model.

Response: We will send you the tiers of priority generated for our latest assessment of the WEST plan. We will provide the data in an Excel spreadsheet, along with the wind turbine identification numbers so that a shapefile can be generated.

Risk Modeling for Unsampled Turbines

We also would like to know the status of risk modeling for the approximately 1000 turbines that were not sampled during your study. Has any risk modeling been conducted for those turbines? Is there additional information needed from us? If these have been included in the risk modeling, please send us the results, as well as the factor values for each of these turbines.

Response: WEST delivered the coordinates of the 1000 unsampled turbines too late to be included in previous assessments by the CEC, and after our collaborators at Lawrence Livermore National Lab ran out of funding. These data have not been integrated with the other data. However, newly obtained funding will enable Lawrence Livermore National Lab scientists to begin working with us again. I will ask Shawn to send you the modeling excel files. He has been spending a lot of time in the field but hopefully can get that to you soon.
****

From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Monday, May 09, 2005 6:32 AM
To: puma@davis.com
Cc: Linda Spiegel
Subject: question

Could you help me understand what the aspect described below is:

Slopes windward to 1 prevailing direction (NW or SW), and perpendicular to the other (2)

Can you give me an example?

Response of 5/9/2005: The definition and an example of 'perpendicular to the wind' are explicitly described in the Smallwood and Neher report. As I suggested the last time you asked me a question, you can read the report to get the answer you seek.
****

From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Monday, May 09, 2005
To: puma@davis.com
Cc: Linda Spiegel
Subject: question

Sorry in advance for these additional questions.

Is the concern over northwest aspects primarily a winter issue, because of the north/northwest winds during that time?
****

>>> Wallace Erickson <werickson@west-inc.com> 05/09/05 3:45 AM >>>

Linda,

In one of our last data requests, we had asked for the individual species risk values that Shawn calculated for the last modeling exercise (MW adjusted). New individual species models were developed, and I had asked for the individual species risk values. Is that a data set that you can
provide, or will I only be given the final risk value (variable labeled tier70)?
****

From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Thursday, June 02, 2005 1:49 PM
To: Shawn Smallwood; Linda Spiegel
Subject: Re: refined assessment to select wind turbines for priority shutdown

Could you send me the shape files and associated dbase files that include the Group A tier value, Group B tier value, the Group C tier value, the unique turbine id, sequence id, and at least a few of the other turbine characteristics fields to make sure I have the correct information regarding your latest turbine risk assessment (June 2005)?

Response of 6/2/2005: You have the Group A tiers (Tier30), Group B tiers (Tier 70), the unique turbine id, sequence id, and several of the other turbine fields. Nothing has changed in any of these fields. You can use Table 1 of the recent assessment to construct Group C tiers.

From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Thursday, June 02, 2005
To: Shawn Smallwood; Linda Spiegel
Subject: Re: refined assessment to select wind turbines for priority shutdown

To avoid any data errors, I ask that you send me one file if possible.

From: Wallace Erickson [mailto:werickson@west-inc.com]
Sent: Thursday, June 09, 2005
To: Shawn Smallwood; Linda Spiegel
Subject: Re: rankings

Any chance you can just send the shape file you used to map the tiers in
your latest report. I am cranking on this right now and it is extremely time sensitive (everything seems that way).

Response of 7/21/2005: The Tier 30 data are attached. The left field is turbine id number, and the right field includes Tier 30 values.
****

Response to Attachment 9 of the California Wind Companies Comments Received on the Assessment of Avian Mortality From Collisions and Electrocutions (Avian White Paper)
August 30, 2005

WRITTEN COMMENTS

All comments are verbatim from Attachment 9 of the California Wind Companies comment letter. CWC quotes from the EPR are italic, followed by CWC comments on that quote.

Responses provided by Commission staff and Dr. Smallwood lead author of *Developing Methods To Reduce Bird Mortality In The Altamont Pass Wind Resource Area.*

CWC-10: The California Wind Companies appreciate this opportunity to comment on the 2005 Environmental Performance Report and offer these comments in conjunction with the attached Reply Comments and the WEST comments on the Staff Avian Report.

Staff Response: Comment noted. As part of the public process industry and all other stakeholders have the opportunity to provide comments and input on the 2005 Environmental Performance Report and Integrated Energy Policy Report Workshops and documents.

CWC-11 *At the Altamont Pass Wind Resource Area in Alameda County, estimates of bird mortality range from 881-1,300 raptors and 1,766-4,721 total birds killed annually.*

This baseline mortality number is the subject of review by the Alameda County Scientific Review Committee as a primary topic. On July 7,2005, the Alameda County Board of Supervisors adopted a framework for permit conditions in the APWRA that includes the initiation of a Scientific Review Committee of recognized experts to openly address recommended wildlife management measures and explore new mitigation measures. We are expecting this board of experts to be empanelled in the near future.

Staff Response: Energy Commission staff welcomes the adoption of a scientific review committee to address the extensive avian mortality issues at the APWRA. Energy Commission staff attended several of the Alameda County Working Group Meetings prior to the meetings being reorganized into the small group meetings. Staff is still available to attend meetings of the Scientific Review Committee and collaborate with the stakeholders in the APWRA to implement a mitigation plan and ensure that data from the 2004 PIER report are properly understood and used to determine appropriate mitigation measures are implemented and their effectiveness monitored.

CWC-12: *Alameda County has instituted a moratorium on wind energy development at Altamont at the existing level of 580 MW until the avian collision issue is resolved.*

The Alameda County moratorium was established to limit wind development in general.

Staff Response: It is widely understood that Alameda County placed a moratorium, or cap, on further development in the wind farm until the avian collision issue is resolved. An Alameda County Staff Report completed for the September 25, 2003 Conditional Use Permit Application states "The main features of the Repowering Program include design and siting standards, a comprehensive Biological Resource Management Plan and an interim limitation on development in the APWRA at the existing level…The development limitations, as currently proposed, would remain part of the Repowering Program until the effectiveness of the program to reduce avian mortality has been firmly established by monitoring, a process which may take several years." This staff report was authored by Andrew Young, a planner for Alameda County.

CWC-13: *Studies from the Solano County Wind Resource Area indicate that raptor species such as red-tailed hawks and kestrels are even more prevalent than at Altamont Pass, which is resulting in higher levels of mortality for some raptors and bats. Developing wind energy resources in Solano County without addressing bird, raptor, and bat mortality could create problems with slow permitting, unacceptably high mortality rates for avian species and negative publicity for the wind energy industry at a second major wind resource area. In order to reduce avian collisions and mortality in Solano County, mitigation measures need to be developed and implemented that are based on thorough field research that determines the extent and causes of mortality.*

As described in the text of the Reply Comments, such statements contradict the extensive and thorough Solano County permitting process for both High Winds and Shiloh projects. Furthermore, these statements are not based on the actual monitoring data that are being collected in Solano County from operating projects. For this reason, the highlighted text should be stricken from this report as the mitigation measures have been developed and are being utilized.

Staff Response: The statement that red-tailed hawks and American kestrels are even more prevalent that at the Altamont Pass are taken from results of raptor baseline surveys that were conducted by Orloff and Flannery (1992). Both High Winds and Shiloh I projects went through environmental review by Solano County. The Shiloh I project was required by the County to redo it's avian impact section and include the post construction survey results from the High Winds project. These types of actions do slow down the permitting process, although staff supports all of the available information being reported and analyzed as part of the CEQA process. Because the County required post construction surveys and the formation of a scientific review committee more information is known about the types of impacts occurring in Solano County. The mortality information should be used to design research that can help answer questions about how to lower avian mortality.

CWC-14: *New research funded by the Energy Commission's Public Interest Energy Research Program seeks to determine what mitigation measures can effectively reduce bird kills at the Altamont Pass to a level that allows for expansion and repowering.*

This statement raises the question of what NEW research is being done when the measures that were recommended in the August 2004 report have not yet been implemented. While seemingly innocuous, the words "effectively reduce" to a "level that allows for expansion and repowering" has led some stakeholders, such as the California Attorney General, to conclude that more study and more mitigation is needed now rather than allow the current, and carefully crafted, Alameda County permitting framework of measures to be implemented and tested for effectiveness. That framework includes seasonal shutdown, repowering requirements, shutdown of high risk turbines and the initiation of an Altamont Environmental Impact Report as soon as possible in addition to the creation of the Scientific Review Committee discussed above. Careful consideration must be afforded to what is already being implemented by Alameda County utilizing previous CEC PIER research and processed through Alameda's County's Scientific Review Committee.

Furthermore, any new research must be identified and discussed in a public forum with full and complete peer and public review as discussed in the Reply Comments.

Staff Response: The PIER program supports the need for new research to determine the effectiveness of mitigation implemented at the Altamont Pass WRA. The Attorney General concluded nothing from the Staff Report but relied on the Smallwood and Thelander (2004) report and subsequent staff assessments. The letter did not conclude that more study or more mitigation was needed but did conclude that mitigation currently proposed should be implemented. The CWC comment misinterprets the letter from the Attorney General's office.

CWC-15: *A few turbine owners have agreed to implement new measures to reduce the number of bird collisions, and some high-risk turbines will be removed or shut down during the winter season when bird collisions are highest.*

This sentence suggests that there is limited participation in the APWRA by turbine owners. The industry has been working hard to implement avian fatality reduction measures, but its efforts have been continually impeded by permitting appeals and environmental lawsuits. The avian interaction issue at APWRA is extremely complex and involves a myriad of stakeholders, including local governmental authorities, resource agencies, regulatory agencies, environmental concerns, and landowners. In 2004 a Wind Power Working Group ("WPWG") was formed by Alameda County comprising all the aforementioned stakeholders, to develop resolutions to the avian interaction issues including appropriate avian fatality reduction measures. Furthermore, industry has begun implementing measures during this WWG process, such as relocating or shutting down high risk wind turbines and power pole upgrades (in addition to the numerous other measures industry has taken over the past two decades). To imply that industry is not fully committed to efforts to reduce bird collisions in the APWRA, without giving due consideration to all the facts, requires clarification.

In fact, all turbine owners will have to comply with the same conditions as set forth by the Board of Supervisors for the APWRA turbines in Alameda County. For example, the turbine owners' proposal for seasonal shutdown is an experimental measure for all of the turbines that have not been repowered to be shutdown 50% at a time for two months of the winter season to determine its effectiveness in reduction of avian mortality..

The sentence should read:

All APWRA turbine owners in Alameda County are being required to implement new measures to reduce the number of bird collision: high risk turbines will be identified and either removed or shutdown, and all turbines will be subject to an experimental seasonal shutdown during the winter when bird collisions are projected to be high and wind production low.

Staff Response: Staff has also been involved in the WPWG meetings and there is limited participation in the APWRA by turbine owners to implement mitigation measures – many operators were not willing to commit to mitigation. In the industry's proposed adaptive management plan (WEST, Inc 2005) there is an exemption from participating for financial reasons and also for projects that repower. Staff interprets that statement as not all APWRA turbine owners will be required to implement the mitigation measures outlined in the industry plan. Staff disagrees with the statement "The industry has been working hard to implement avian fatality reduction measures, but its efforts have been continually impeded by permitting appeals and environmental lawsuits.", as the reason for the law suit is that no mitigation was being performed by the operators.

Staff supports a seasonal shutdown and scientifically robust monitoring effort to determine the effectiveness of that measure.

CWC-16: *Several agencies and an industry consortium have prepared guidance documents that describe best practices for reducing avian collisions and mortality, but the guidance is not widely used or uniformly adopted. Fragmented* *jurisdiction between local, state, and federal agencies and non-coordinated regulatory programs contribute to an inefficient regulatory approach. Most species of birds and raptors are protected under the Migratory Treaty Bird Act and the Bald Eagle Protection Act, but neither statute is being used effectively to reduce fatalities of hawks and eagles.*

Enforcement of the Federal statutes would NOT create new mitigation measures for avian mortality but rather would create a strict liability criminal penalty that would discourage the operation of the wind turbines. The jurisdictions have been attempting to coordinate efforts to ensure the greatest degree of avian mortality reduction, relying on the counties as the source of primary permitting jurisdiction.

Staff Response: Guidance documents have been developed to develop monitoring and research and to help site turbines while reducing avian impacts. These documents are not always used. The U.S. Fish and Wildlife Interim Guidelines recommend 3 years of pre-construction surveys. Staff is unaware of these recommended guidelines being utilized by local agencies or industry during the permitting process in California. These guidelines also include additional mitigation measures that could be utilized to lower avian impacts.

CWC-17: *Further, most bird species being killed are protected under state and federal laws and are thus of concern to the public at large as well as environmental and wildlife law enforcement officials.*

What does this mean? How is it substantiated? Since most bird species have protection under state and federal, this statement needs to distinguish the impacts caused by wind turbines from all other sources of avian mortality.

Staff Response: We do not understand the commentor’s surprise at this statement. Concern has been expressed by researchers over the last 20 years as information has been gathered statewide. Concern has also been expressed through the environmental community (Audubon and CBD lawsuits), the California Attorney General’s Office (letter enclosed in Attachment 7 of the CWC comments), and in the National Wind Coordinating Committee guidelines (Anderson 1999). In many of the Environmental Documents completed recently and reviewed by staff for the Avian Staff Report there have been many groups and individuals concerned with avian mortality. Also, as part of the process to renew permits for existing projects in the APWRA the county established a working group, has asked for input from regulatory agencies and developed a scientific review committee (some of these measures have been done in recent projects in Solano County). As discussed in the Avian Staff Report, birds are killed by other human induced actions which is exactly why cumulatively avian fatalities should be addressed and mitigated. Energy Commission staff believes if mitigation can be applied to reduce impacts than it should be.

CWC-18: *As wind energy production expands, the rotor swept area of turbine blades increases and more birds will be at risk of collision.*

Does this mean the size of the turbine? The amount of generation? The swifter the blades? The number of turbines?

Staff Response: Rotor swept area means the area of air space contained with the sweep of the rotor blade. It is a common metric. As rotor swept area increases so will the probability that a bird can come into contact with the rotor swept area. Even at a stable fatality rate more birds can be killed with expansion.

CWC-19: *To lower risks to birds, the developer should conduct protocol level bird use surveys prior to development. Expansion or repower projects should be required to incorporate mitigation measures and monitoring, and to report the results so fatality rates and mitigation efficacy can be assessed. Using that information, they can then site turbines to avoid areas of high avian use. Additional wind development to meet the RPS goals is feasible while at the same time limiting the avian impacts.*

This type of survey, mitigation and monitoring is already being performed and required as part of the permitting processes at the County level. If the counties are told that the California Energy Commission, or its staff, believes that more needs to be done than is currently being identified through comprehensive environmental review, such statements in this Staff Report can hinder the development of new wind projects rather than make it feasible.

Staff Response: Staff is recommending that adequate surveys and siting criteria be used when developing wind projects. If these measures are already being performed as part of the permitting process then there is no reason for new development to be hindered as you suggest. It is only the projects that the suggested measures are not being performed at that should provide additional information. As reported in the Avian Staff Report, there are several projects that have had to redo environmental documentation and provide additional information such as; Buena Vista (Altamont Pass), Shiloh (Solano County), and Pine Tree (Tehachapi Pass).

CWC-20: *The wind siting and mitigation guidelines produced by the National Wind Coordinating Committee and the U.S. Fish and Wildlife Service to date are voluntary and the level of implementation by industry and local agencies vary. Statewide guidelines for wind energy projects may be an appropriate way to gain consistency statewide when developing and mitigating projects. Statewide standards could also remove a significant environmental barrier to increasing wind energy in the state.*

See Reply Comments of California Wind Companies (attached). Statewide guidelines would give the CEC *de facto* siting jurisdiction and ignore the unique qualities of each resource area and technology.

We believe that the current regulatory structure which vests the primary siting authority for wind in local government and utility districts is working well and does not need fundamental change. In the Alameda County permitting process for the APWRA, several CEC PIER Staff Assessments were issued with the stated purpose of assisting the County's permitting process. Yet, among other issues, these documents contained contradictory results regarding the nature and identification of high-risk turbines to be selected for permanent shutdown, and illustrate the uncertainty with their estimates of turbine risk and the need for peer and public review.

This section leaves the impression that the wind industry is ignoring available siting and survey guidelines. In the specific example used concerning guidelines published by the National Wind Coordinating Committee ("NWCC"), the industry was directly involved with preparation of these guidelines as a participant in the NWCC. In the specific example of the industry taking issue with implementation of the USFWS's voluntary interim guidelines, the issues taken generally revolve around these guidelines having been issued without wind industry involvement and their being treated in certain regions of the U.S. as mandatory without regional discretion, rather than as voluntary guidelines. The American Wind Energy Association ("AWEA"), the principle wind industry trade organization, has represented the industry to the USFWS and has lately been successful in involving the industry in the USFWS's efforts to improve their guidelines and to have them implemented in a way that keeps regional siting issues in focus, since environmental considerations vary greatly from region to region.

Staff Response: Staff is proposing guidelines, such as those that exist in Washington State. The Washington State guidelines were developed to support a local permitting process and can help lend consistency statewide. There was nothing in the Staff Report or the EPR which stated that staff was recommending that the Energy Commission take over permitting wind projects in the state. The Energy Commission has supported research statewide since the late 1980's. It is important to apply that research to resolving the problems and not just continuing the monitoring and reporting on an existing and ongoing issue.

The Energy Commission staff assessments were prepared at the request of stakeholders, including industry that attended the Alameda County Working Group meetings. The Assessments were prepared using specific criteria that were requested by the wind companies, and based on the assumptions used the turbines identified for shut down changed. See Staff Response to CWC-7 for additional information

Staff agrees with the CWC comment that the USFWS and NWCC guidelines are voluntary to date. As a result the guidelines are rarely implemented.

CWC-21: *In the Altamont Pass Wind Resource Area, the Energy Commission Could Encourage Industry to Apply Mitigation Measures to Existing Projects, New Projects and Repowering Projects to Reduce Bird Deaths*

The California Wind Companies take exception to the "encouragement" unless there is a formal public and peer review process followed. As discussed above, the APWRA has already had a comprehensive process before the Alameda County Board of Supervisors, including input from PIER staff that resulted in a permitting framework.

We recommend revising the text as follows:

Over the last 20 years, researchers have documented the levels of bird use and mortality in the Altamont Pass. PIER-EA funded studies to develop a list of mitigation measures that could reduce bird kills (Smallwood and Thelander 2004, Smallwood and Neher 2004,). As a next step, industry will implement the mitigation measures selected by Alameda County and monitor those measures Altamont-wide to determine their effectiveness. Two measures that are projected to reduce bird kills are seasonal shutdown (winter months) or removal of wind turbines in the highest risk areas. While these measures are anticipated to reduce bird kills, implementation will also result in a loss of generation.

Staff Response: Comment noted. Staff will continue to support the implementation of mitigation measures, and monitoring of those measures to determine effectiveness at the APWRA.

CWC-22: *In the Solano County Wind Resource Area, the Energy Commission Could Encourage Industry to Reduce Existing Impacts on Birds and Bats*

Solano County has already addressed these issues as part of its CEQA process. As discussed in the specific comments on the Staff Avian Report, the information needed to assess the impacts of the operation of the High Winds project is being collected and analyzed by a Technical Advisory Committee. This paragraph should acknowledge those efforts rather than dismiss them. High Winds is one of the more recently licensed and operational wind projects utilizing modern wind technology.

NOTE (for the topics on the rest of p. 16): Any suggestions for further research must be prefaced by indicating that it will be subject to full peer and public review according to Commission-adopted protocols before being released.

Staff Response: As part of the CEQA process potential impacts from the High Winds project were discussed. Levels of avian mortality are higher then what was projected in the High Winds EIR. The Energy Commission staff is encouraged that post construction monitoring is occurring, and hopes that the information can be used to reduce impacts to avian and bat species in Solano County.

See responses to CWC-1 for comments on peer review

CWC-23: *Wind power and Avian Mortality*

See previous specific comments

Staff Response: Comment noted

CWC-24: *Wind Energy*

We have provided specific comments on the Staff White Paper that has been referenced in the WEST Comments.

Staff Response: Comment Noted

CWC-25: *The mitigation measures developed for the Altamont Pass still need research to determine their effectiveness. These mitigation measures are currently not implemented elsewhere since more information on bird behavior and risk is needed for other wind resource areas.*

We agree.

Staff Response: Comment noted

CWC-26: *Using New Mitigation Measures to Site Turbines in the Altamont Pass*

Highlighting only the Buena Vista project ignores the efforts that have been made at other repowered projects, namely Diablo Winds, High Winds, and Shiloh, all of which utilize new wind technology. It should be noted that Mr. Smallwood served as a consultant to the Buena Vista project.

Staff Response: Mitgation measures proposed in the Altamont Pass report (Smallwood and Thelander 2004) are specific to the Altamont Pass. We are unaware of what mitigation measures to reduce bird kills were implemented during the construction of the Diablo Winds. Staff have not recommended that the mitigation measures developed for the Altamont Pass be used at the High Winds and Shiloh projects in Solano County without rigorous monitoring since the effects of the measures need to be clearly understood. Staff in the Avian White Paper also highlighted the Shiloh I project. We do not know what you are implying by the comment "Mr. Smallwood served as a consultant to the Buena Vista project**".** We are aware that Dr. Smallwood and industry's consultant WEST were co-authors of the environmental assessment for the Buena Vista project.

CWC-27: *To help lessen the avian impacts of wind turbines, staff believes the Energy Commission may want to consider various policy options that are included in the 2005 Environmental Performance Report white paper entitled Assessment of Avian Mortality from Collisions and Recommendations [sic].*

Before considering the policy options in the Assessment of Avian Mortality from Collisions and Electrocutions, (CEC 700-2005-015), the California Wind Companies recommend that the Commission conduct a comprehensive public review process for that document and its underlying research taking into consideration the comments received as part of the IEPR proceeding.

Staff Response: Comment noted. As part of the public review the California Wind Companies participated on a panel at the June 28, 2005 workshop and has provided extensive comments on the reports and their references.

Response to Carol Pilz Weisskopf, Ph.D Comments Received on the Assessment of Avian Mortality From Collisions and Electrocutions (Avian White Paper)
August 30, 2005

WRITTEN COMMENTS

All comments are verbatim from the Carol Pilz Weisskopf, Ph.D comment letter

Responses provided by Commission staff and Dr. Smallwood lead author of *Developing Methods To Reduce Bird Mortality In The Altamont Pass Wind Resource Area.*

CW-1: In the California Energy Commission's 2005 environmental performance report, avian mortality caused by turbine blade strike is given as the primary biological impediment to wind development. Mortality estimates for the Altamont Pass wind resource area (APWRA) are given as 881 - 1,300 raptors and 1,766 - 4,721 total avian deaths annually. The Solano County wind resource area is also listed as having unacceptable avian and bat mortality: and the report indicates that the Tehachapi Pass, San Gorgonio Pass and Pacheco Pass wind resource areas require additional studies ‘using more current research protocols' to confirm the low mortality found by previous studies in those areas.

Staff Response: The comment is a summary of comments provided later in the letter. Each comment is individually responded to below.

CW-2: One staff document in support of the environmental performance report discusses turbine-related avian mortality, and states "The numbers of birds killed by other human actions are sufficiently large to conclude that any additional mortality caused by wind turbines qualifies as a considerable environmental impact." Although the implication is that even one avian fatality in a wind park would be too many, the magnitude of the cited numbers for the APWRA are indeed cause for alarm.

Staff Response: Staff’s statement was to acknowledge these other sources of mortality as cumulative impacts, which should heighten concern over wind turbine-caused mortality, rather than lessen concern when there are mitigation measures available that can potentially reduce impacts. The statement does not imply that one avian fatality in a wind park would be too many.

CW-3: The staff findings and policy options for dealing with wind turbine mortality include: development of new wind resources only in areas of low avian risk; bat use, behavior and carcass surveys at all existing parks; industry mitigation of avian impacts; industry mitigation measures in the APWRA to reduce avian mortality; industry research and mitigation measures in the Solano County wind resource area to reduce avian and bat mortality; and additional research in the Tehachapi, San Gorgonio and Pacheco Pass wind resource areas.

The amount of activity that could be generated by the listed policy options would be extensive, costly, and restrict or delay new facilities. Such steps are only justified if the mortality estimates upon which avian concerns are based are accurate. As the mortality estimates given in the environmental performance report are from Smallwood and Thelander their study was reviewed to determine the extent of confidence that should be placed in these numbers.

Staff Response: Staff recommends the above policies as options to reduce avian mortality from collisions with wind turbines and as a result allow for expansion of wind resources in the State. Staff relied on a wide body of historical knowledge that has been conducted statewide for the Avian White Paper (see references pgs 37-42 for a partial list of available wind related publications). Staff is aware of several projects were delayed due to issues including avian mortality.

CW-4: Most mortality estimates of turbine-related avian impacts are the product of a series of assumptions and numerical extrapolations. The validity of each step of the extrapolation should be examined. This includes the assumption that the baseline data are correct and that the extrapolations include all relevant factors. The turbines monitored need to be representative of the total resource, background avian mortality needs to be considered, the extrapolation factors need to be defensible, and the time span of the study needs to be adequate. When discussing mitigation or reduction of mortality, the assumption that the cause of mortality has been accurately identified and that the remedy proposed will be efficacious needs to be examined. The steps in mortality extrapolation and the proposed mitigation procedures of Smallwood and Thelander will be demonstrated both generally and for two specific birds: the golden eagle and the ferruginous hawk.

Staff Response: Smallwood and Thelander examined each of the steps advocated by Weisskopf for examining validity in making assumptions and extrapolations to derive at mortality estimates. Their examination is summarized in the Smallwood and Thelander (2004) (Also referred to as the 2004 PIER Report).

CW-5: The baseline data were generated by standard carcass searches. Two groups of turbines – the first consisting of 1,525 turbines with a rating of 151 MW and the second 2,548 turbines with a rating of 267 MW – were searched. Turbines in the first group were searched for various periods, ranging from somewhat less than one year to 4.5 years, and the second group was searched twice during approximately a 4-month interval. Evaluation of these data focuses first on the confidence that the mortality was turbine related. Some of the birds attributed as turbine kills were found as far as 220 m (720 ft) from the tower, despite the formal search radius of 50 m. And notwithstanding the prevalence in the APWRA of above-ground electrical lines and guy wires, only 0.8% of the mortalities were identified as electrocution deaths and 0.2% as wire strikes. All carcasses for which the cause of mortality was unknown, nearly 10% of the total, were added to those already attributed to wind turbine blade strike. Of 1,189 carcasses found, all but 27 (2%) were attributed to turbines.

The baseline data were not corrected for background mortality – i.e. the number of avian deaths that would occur at the site in the absence of turbines. It would be naïve to expect that birds in the Altamont never die of natural causes. Hunt found that approximately 35% of juvenile golden eagles die in fledging accidents. Lifespan of golden eagles is given as approximately 20 years; ferruginous hawks have a similar lifespan. Of the total population of both species in the APWRA, 5% could be expected to die from aging each year in the absence of turbines. Approximately 8 – 10% of burrowing owls and American kestrels would also reach the ends of their lifespan each year. Hawks, eagles and owls in the APWRA prey upon each other and on other birds present at the site, which would contribute to carcasses with evidence of trauma. Hunt also reported golden eagle deaths from lead and pesticide poisoning and botulism. High avian populations in the APWRA should suggest the possibility of high background mortality, yet this was not considered in the avian mortality calculation. Although there are undeveloped areas of the APWRA with terrain similar to that containing turbines, these areas have not been searched to estimate the site's background mortality.

Staff Response: As Weisskopf points out in her comments Smallwood and Thelander (2004) did categorize the carcasses they found by what caused their death and the type of injury they had (pages 30-31, Figures 2-2 and 2-3 reproduced below). Although raptors do kill and eat each other, as Weisskopf says, the trauma evident on carcasses does not look like the types of injuries caused by wind turbines – severed wings, tails, and heads, and cut torsos. Birds that die of natural causes would also not exhibit the types of injuries that birds used in the analysis had and would be excluded from the analysis. Therefore, birds that die of natural causes may be in addition to the birds reported on in the 2004 Report but are not a subset of the bird deaths attributable to wind turbines, and therefore do not change the reported baseline data of birds killed by wind turbines.

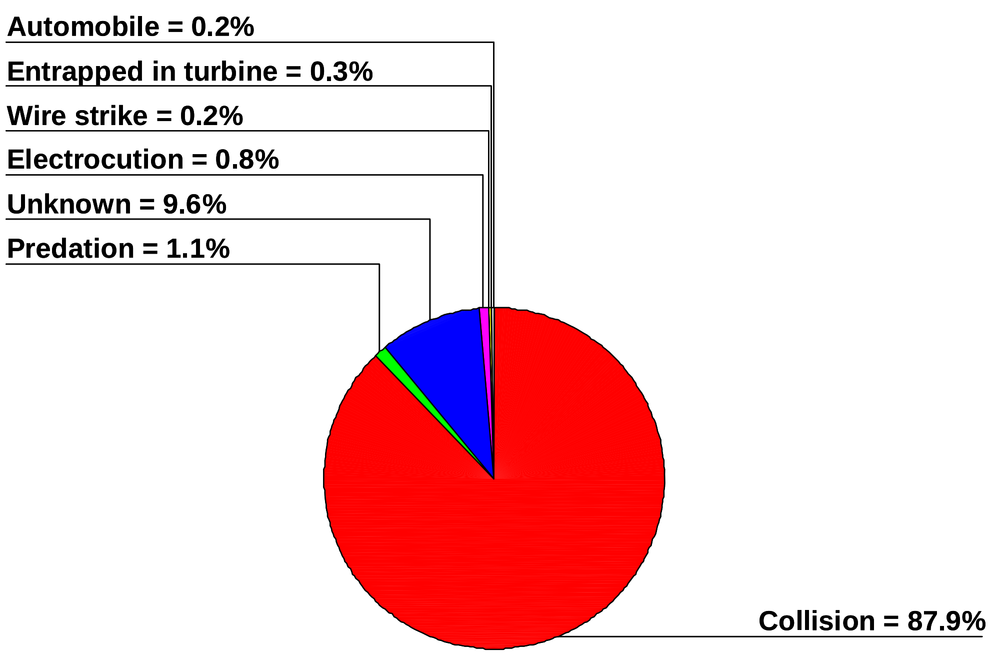


Figure 2-2. Pie-chart distribution of causes of fatalities attributed to carcasses found in the APWRA

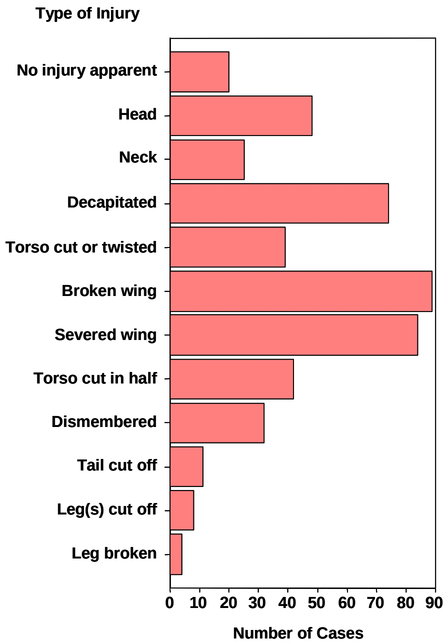


Figure 2-3. Frequency distribution of types of injury attributed to wind turbine-caused fatalities among birds found in the APWRA.

Weisskopf also cites the golden eagle fledging accident rate of 35% (Hunt 2002), but the fledging eagles in Hunt's study area occurred in areas outside the APWRA. Whereas fledging accidents take a third of golden eagle juveniles, these accidents do not happen in the APWRA. Two of the dead golden eagles found in the APWRA that were reported in the 2004 Report (page 32) were electrocuted.

Although Weisskopf points out factors that may reduce mortality estimates, we can identify factors that could increase the mortality estimates. For example, as the 2004 report (page 52) points out, some raptors were found buried under rocks and stuffed into ground squirrel burrows. Smallwood and Thelander also point out that at least one golden eagle carcass found and removed by the wind turbine owners as part of their Wildlife Reporting and Response System (WRRS) and was not brought to their attention. Smallwood and Thelander made no adjustment to their mortality estimates in Chapter 3 for this error rate. Regarding the fact that some birds found at a distance from turbines, Smallwood submitted to the National Renewable Energy Lab his eye-witness report of a rock dove struck by a wind turbine and thrown 50 m. Smallwood and Lourdes Rugge approached the bird and found it alive, but it flew up and away from the wind turbine another 150 to 200 m before it fell to the ground, where it was later found dead. We suspect wounded birds likely often flush when predators approach them, and end up so far away from wind turbines that they are never discovered.

WEST (Johnson et al 2000), conducted a study to estimate background mortality at another wind farm. They concluded there was too little natural mortality to continue with that effort and decided to attribute all mortality to wind turbines. In their report of bird collisions with wind turbines in the Stateline project, WEST did not make any effort to estimate background mortality. In the monitoring plan for the Buena Vista Wind Power Project in Contra Costa County, which was principally prepared by WEST, no effort to estimate background mortality was planned. In addition, the lead author of the San Gorgonio study stated in a personal communication that there was too little mortality not caused by turbine blades in wind farms to justify the time and cost of the effort and that nearly all fatalities were turbine-caused (Richard Anderson, personal communication July 2005).

Weisskopf argues that Smallwood and Thelander (2004) likely misdiagnosed electrocutions as wind turbine collisions. Electrocuted birds were found under distribution poles, turbine-caused deaths were found under or near wind turbines. Furthermore, electrocuted birds often show signs of electrocution, such as singed feathers or flesh, entry and exit wounds, or curled talons. The fatality search crews were familiar with these types of wounds.

Staff is unsure how Weisskopf determined that 5% of ferruginous hawks and golden eagles would die of natural causes each year and that for other species 8-10% would also reach the ends of their lifespans. Even if 10% of the birds were removed from the sample it might have resulted in mortality estimates about 10% smaller, so perhaps instead of 75 to 116 golden eagles per year, the correct estimate would be 68 to 104 golden eagles. Instead of 1766 to 4721 birds per year, perhaps the correct estimate would be 1589 to 4249. Staff believes that this is still a significant amount of birds dying, and that mitigation should be applied to lessen the impact. The focus of the 2004 Report was to “study bird behaviors, raptor prey availability, wind turbine/tower design, inter-turbine distribution, landscape attributes, and range management practices in their effort to explain the variation in bird mortality with the goal of developing predictive models that could be useful for future planning decisions in the APWRA” (2004 Report p 1).

CW-6: In Smallwood and Thelander, the baseline data were expressed as deaths/MW/year for each of the two sets of turbines monitored. The fatalities were extrapolated from the specific searched groups of turbines to the Altamont as a whole by calculating a MW-weighted average of the two sets and applying it to the unmonitored turbines. If 151 birds died per year in the first turbine set (with 151 MW) that would yield a value of 1 mortality/MW/year. If 534 birds died per year in the second turbine set (with 267 MW) that would yield a value of 2 mortalities/MW/year. The unmonitored turbines (162 MW) would then be calculated as 1.6 mortalities/MW/year, and all added to arrive at the total APWRA mortality (for this example 950 birds/year).

Review of the estimated Altamont mortality total raises a number of questions for the thoughtful reader. Golden eagle deaths in the first turbine set were calculated as 0.038 deaths/MW/year, while 0.14 deaths/MW/year were calculated for the second set, more than three times higher. The second turbine set accounted for 63% of projected total golden eagle mortality. Use of the first turbine set alone would have resulted in a total annual APWRA mortality, before extrapolating for searcher efficiency or scavenging, of approximately 22 eagles/year, while the total with both sets was approximately 59 eagles/year. For ferruginous hawks, no mortalities were found in the first turbine set after searching for up to 4.5 years. The second set, searched for approximately 4 months or less, yielded 2 carcasses18 and accounted for 100% of the projected

APWRA mortality – a number that, before extrapolating for searcher efficiency and scavenging rates, was approximately 13 ferruginous hawks per year as compared to no hawk mortality calculated from the first turbine set.

Staff Response: Weisskopf concludes that the mortality estimates were unduly influenced by fatalities recorded during a relatively short fatality search period at 2,548 wind turbines composing Set 2 (see Table 3-10 in Smallwood and Thelander 2004). She points out differences in the number of golden eagles and ferruginous hawks found dead between two sets of wind turbines searched over two different time periods. We agree the estimates differ with or without the Set 2 turbines, which is the very reason Smallwood and Thelander presented the estimates for Set 1 turbines alone in Table 3-10. Smallwood and Thelander provided the reader the means to calculate annual APWRA-wide estimates based on Set 1 turbines, Set 2 turbines, or Sets 1-3. In order to facilitate our response to Weisskopf, we made the calculations for some of the species and present them here (Table 1). To calculate APWRA-wide mortality only from Set 1 turbines, simply multiply 580 MW against the per-MW mortality values under the column labeled ‘Set 1’ in Table 3-10.

Table 1. Comparison of APWRA-wide mortality estimates extrapolated from turbines composing Set 1 versus those in Sets 1 through 3.

Species/Group	**Estimated annual APWRA-wide mortality**	
	Only Set 1 wind turbines	**With second set of 2548 wind turbines**
Golden eagle	28-34	76-117
Turkey vulture	7-8	2-3
Red-tailed hawk	232-280	209-300
Ferruginous hawk	0	15-24
American kestrel	44-111	73-333
Burrowing owl	133-336	99-380
Great horned owl	17-20	8-10
Barn owl	55-67	36-49
California gull	26-64	10-23
Black-crowned night heron	4-10	2-4
Mallard	127-306	59-154
Rock dove	765-3866	387-2527
Mourning dove	257-1299	116-704
Horned lark	63-319	23-115
Western meadowlark	319-1611	309-2557
Loggerhead shrike	31-154	23-176
House finch	70-354	25-128
All hawks	399-482	375-542
All raptors	742-896	881-1300
All birds	2604-5672	1767-4721

In Table 1 we see that some mortality estimates are higher in the absence of the Set 2 (and Set 3) turbines (e.g., turkey vulture, great horned owl, barn owl, California gull, mallard, house finch, all birds as a group), and some are higher with the Set 2 turbines (e.g., golden eagle, American kestrel, rock dove, mourning dove, all raptors as a group). Weisskopf pointed out the two species whose estimates differ widely between the two sets of estimates – golden eagle and ferruginous hawk -- but overall bird mortality is estimated to be greater when one calculates it only from Set 1 wind turbines. The reason for these differences is, in large part, due to the different conditions including turbine type and bird use that occur between the sets of turbines; different conditions pose unique risk factors.

Smallwood and Thelander (2004) calculated the values in Table 3-11, which presented the annual APWRA-wide estimates derived from all three sets of wind turbines, because they could not ignore the fact that the last set of wind turbines accessed – Set 2 – revealed more golden eagle fatalities in half a year than were found during the entire four years of fatality searches among the wind turbines composing Set 1. We believe this indicated the second set of turbines posed a far more serious problem to golden eagles. It should be noted that based on information collected at Set 1 turbines, the larger number of golden eagle deaths at Set 2 turbines was not surprising. However, the wind operators would not grant Smallwood and Thelander access to the Set 2 wind turbines until the last 6 months of their study. As Set 2 shows, more golden eagle carcasses were found there during the relatively brief survey period directed towards those turbines.

In their Chapter 3 and Appendix A, Smallwood and Thelander (2004) acknowledged the mortality estimates calculated from the latest 2,548 wind turbines searched were less reliable than they would have been had they been searched over three years. Whereas the mean mortality estimate does not change with increasing fatality search duration, the variation decreases and therefore reliability improves over time. In the final analysis we cannot know to what extent the differences in golden eagle and ferruginous hawk mortality estimates in Table 1 are due to differences in reliability versus differences in real mortality. Because ferruginous hawk carcasses were found among Set 2 turbines and not among Set 1 turbines, and because many more golden eagle carcasses were found among Set 2 turbines compared to Set 1 turbines, Smallwood and Thelander (2004) concluded the differences in mortality estimates between the two sets of wind turbines are much more substantial than they are reflective of differences in reliability of estimates due to differential search duration. Smallwood and Thelander (2004) decided to include data from the second set of 2,548 wind turbines in their mortality estimates, but they warned the reader several times about cautiously interpreting the reported mortality estimates. They decided to make the most use of the data they had, but they also recommended that future fatality studies in wind farms be conducted for a minimum of three years. Their recommendation for a three-year minimum applied to future fatality monitoring efforts was facilitated by the differential sampling effort they implemented.

Had Smallwood and Thelander (2004) not reported mortality estimates derived from all the wind turbines they searched, including those in Set 2, they would have ignored a significant set of data. Additional fatality searches in the APWRA would have to be performed to confirm the magnitudes of the mortality estimates derived from the Set 2 turbines, while also improving the precision of the estimates.

CW-7: Smallwood and Thelander speak extensively about the reliability of mortality estimates derived in studies lasting less than one to three years:

“Our new mortality estimates are much larger than those reported in Smallwood and Thelander (in review), but our report to the National Renewable Energy Lab did not include data collected over most of the APWRA where we had not yet been granted access, and it did not include data from the wind turbines because we had not yet completed a full year of fatality searches on these turbines and decided to exclude them from our estimates of mortality. In fact, we had noticed that the mortality estimates representing the Sea West-owned turbines were much larger than observed elsewhere, but we guessed that these larger estimates might be due to time spans consisting of less than a year because the denominator in the mortality estimate would be a fraction and would therefore artificially inflate the mortality estimate, as described in Chapter 3.”

“An important point to consider when comparing any standardized measure of mortality between sites is whether the variation in mortality was partly a function of the duration of monitoring used to derive the mortality estimate. Variations in mortality estimates will decline as the monitoring duration increases, and this decline will be most rapid for estimates derived from monitoring that lasts less than a year . . .”

“Mortality estimates based on less than one year of searching are more variable and should be cautiously interpreted when comparing mortality between sites.”

“We also found that the variation in mortality estimates is a function of the monitoring period during which carcass searches were performed. Dividing a relatively constant value by a continuous variable will relate to the continuous variable as an inverse power function. . . . Any monitoring duration less than three years is likely to yield unreliable estimates of mortality.”

One rarely sees authors so thoroughly repudiate the fatality projections of their own report. Smallwood and Thelander had access to the second, larger set of turbines only for the final 6 months of their study. From their graphical presentation, searching of some turbines apparently began approximately 2 months after access was granted and the latest apparently 3.5 months after access. The maximum study duration for the second set of turbines would therefore be 2.5 – 4 months. The first search set also included at least five strings, with an unknown number of turbines, apparently studied for less than one year. The unreliability of data from studies lasting less than one year, and the preference for studies of three year’s duration, was reiterated by a commission staff presentation stating “3 years of monitoring necessary to yield reliable results.

Staff Response: The authors of the 2004 Report were up front about the limitations of the research results they were presenting. They wanted to thoroughly examine the data leading to their estimates, and as cited by Weisskopf above, Energy Commission staff as well as the authors of the 2004 Report have acknowledged that 3 years of data collection leads to more precise results of **mortality estimates**. Mortality is the rate of fatalities per MW or turbine over time and is useful in when comparing mortality between sites. Weisskopf gives the impression that these mortality estimates were the basis for model predictions, which is incorrect. The measured set of **fatalities** was used, meaning the actual fatalities found were related to association variables, and no rate extrapolations were made prior to estimating associations. Shortfalls in study design, analysis or interpretation of results as they relate to mortality estimates do not necessarily relate to estimated fatality associations. (See also Staff Response to CW-15 and CW-17).

The first paragraph of the Discussion section in their Chapter 3, which occurs just prior to a quote she recites and which discusses their acknowledged shortfalls in making mortality estimates states:

"Whereas we standardized our estimates of mortality by dividing the number of fatalities per MW and by the years spanning the search effort, our estimates of mortality might have been influenced by variable search efforts expressed as the number of years spanning the search period. For example, if few fatalities happened during a particular year, and we searched a group of wind turbines only during that year, then our mortality estimate from those wind turbines will be less than from other wind turbines and the comparison compromised. This shortfall was beyond our control, since the owners of the wind turbines allowed us access to various new groups of turbines at different times during the study. For example, we did not gain access to our last addition of 2,548 wind turbines until late in 2002, after we completed our searches at all other wind turbines. However, this shortfall exists and needs to be divulged herein." (2004 Report page 76)

Smallwood and Thelander honestly acknowledged study design shortfalls in calculating **mortality estimates** that were beyond their control. See Staff Response to CW-6 for more information on why the authors of the 2004 Report thought that it was important to report all of their results. Additional years of research would in fact result in more precise mortality estimates but not necessarily the pattern of fatalities used as the basis for developing predictive models. Again, the authors fairly, accurately, and honestly tried to account for differential sampling effort resulting from their incremental access to wind turbines in the APWRA.

CW-8: The second monitored turbine set had an undue influence on the calculation of total estimated APWRA mortality. First, because it had a larger MW value than the first set, it contributed nearly two thirds of the mortality estimate for the unmonitored turbines and for the resource area as a whole. Second, because the survey period was so short – for some sites apparently less than 2 months – mortalities were multiplied to adjust for the fraction of year searched. These data carried equal significance in the total mortality calculations despite the concern the authors expressed about the reliability of short-term data. To be sure, for several species (such as northern harrier and turkey vulture) this resulted in a lower estimate of total site mortality than would have been the case had the second set been omitted.

In the next step in extrapolation of observed deaths, mortality estimates were first corrected for the efficiency of the searchers in locating carcasses (producing the lower number in the ranges given for APWRA mortality), and then for the proportion of carcasses that may have been present but removed by scavengers (producing the higher number in the ranges). Searcher efficiency is largely related to bird size, and scavenging to interval between searches. The search interval was given as 53 ± 11.6 days for the first turbine set, and 90 days for the second set. Correction factors used were based on numbers reported by other researchers at the APWRA, and ranged from multiplication of observed raptor mortality by 1.2 in both turbine sets to correct for searcher efficiency, to multiplication by 10.2 to correct for scavenging of small non-raptors in the second set of turbines searched. With the corrections for searcher efficiency and scavenging included, the golden eagle mortality contributed by the second turbine set accounted for 71% of the total estimated mortality, with 116 eagles per year using both data sets and 34 eagles per year if the second set is omitted. The latter number is consistent with the estimate of 39 golden eagles per year found by previous researchers. Ferruginous hawk deaths were projected at 24 per year after correction, as compared to no mortalities if the second data set is omitted.

For small non-raptors in the second turbine set, the combined multiplication factor for searcher efficiency and scavenging was 25, indicating that searchers found only 4% of the carcasses and the remaining 96% were missed or removed. In other words, for every 100 small birds hypothesized to have been killed by those turbines, less than two were actually found and counted since the study lasted less than half a year. For small birds in the second turbine set, the variability introduced by the short study duration is thus exacerbated 25-fold by this extrapolation. The magnitude of these 'correction factors' throws serious doubt on the validity of these data. While the extrapolations are less egregious for the larger birds and raptors, small birds constitute a large proportion of the total estimated kill for the APWRA.

Staff Response: Weisskopf is correct that Smallwood and Thelander (2004) utilized correction factors to extrapolate raw mortality estimates to adjusted mortality estimates, as is common practice. She is incorrect, however, in her claim that a combined multiplication factor for searcher efficiency and scavenging was 25 for small non-raptors in the second turbine set. The multiplier used for these birds found among the second turbine set was actually 6.98, and this multiplier includes the correction for turbine-killed birds occurring outside the 50-m search area. How Weisskopf came to conclude the correction factor was a multiplier of 25 is not clear in her comment, but it is clearly incorrect and exaggerated based on the data and adjustments presented in Smallwood and Thelander (2004).

CW-9: The uncertainty introduced by the size of the correction for scavenging, particularly for the second turbine set, is an indication search intervals were too long. Their correction method for scavenging for both turbine sets also contains a logical flaw – it assumes all birds dying during the search interval died on the first day of the interval. If 80.2% of small birds are scavenged in 40 days, and 100 birds died on the first day of a 40-day interval, you would find 20 birds (or, more precisely 19.8 birds) on the 40th day. To find out (from the 19.8 birds found) how many died on the first day, you would multiply by 5.05 and get 100. Smallwood and Thelander divide their small bird carcasses in the first turbine set by 0.198, mathematically the same as multiplying by 5.05. Birds, however, do not all die on the first day of the interval, but should be expected to die roughly evenly throughout the period. During each 10 days of a 40-day interval, approximately 25% of the birds would be expected to die. For a hypothetical 100 birds dying during the interval, 25 carcasses would be there 10 days or less, another 25 there for 10 – 20 days, etc., and 80% of birds are *not* removed in 10 days. Assuming all birds died on the first day of the search interval results in a gross over-correction for scavenging, and other current avian studies do not make that mistake.

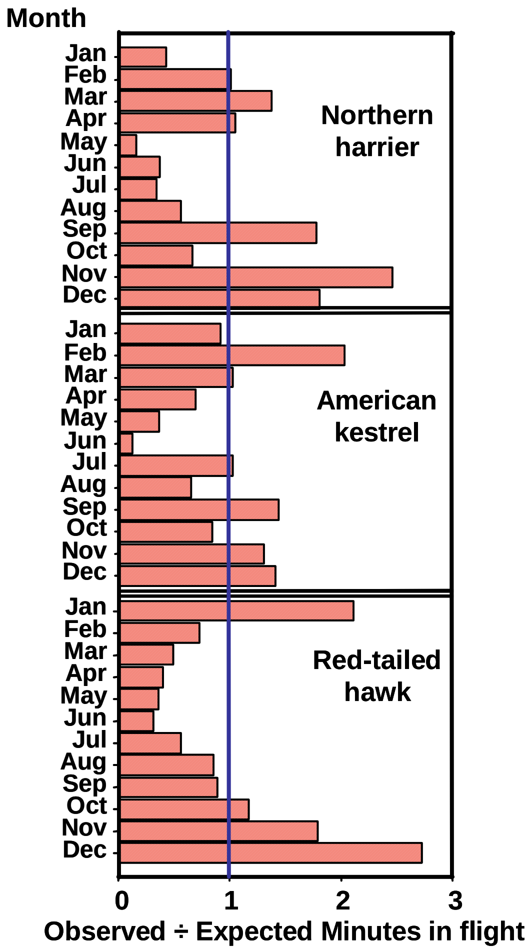
Staff Response: Weisskopf makes the point that Smallwood and Thelander's correction factor applied to small birds scavenged from the first set of turbines did not account for collisions occurring throughout the search interval. Smallwood and Thelander (2004, page 51) wrote, "Our average search interval was 53 ± 11.6 days for the first set of 1,526 wind turbines included in our first rotations, and 90 days for the second set of 2,548 wind turbines. Therefore, we adopted the carcass removal rates of Erickson et al. (2003) for the first set, assuming scavenger removal rates were similar between 40 days in their study and 53 days in ours, and we added 10% to these rates for the second set of 2,548 wind turbines, resulting in estimates of 68.6% of carcasses of large-bodied species removed between searches and 90.2% of carcasses of small-bodied species." Whereas we acknowledge turbine-caused fatalities likely occurred throughout the 40-day term for which the correction was originally estimated in Oregon, we also point out that the term in our case was 53 days. Therefore, a fudge factor was built in, especially for the fatalities found among the second set of turbines.

Weisskopf's example includes 100 fatalities of small birds during one 40-day search period, and she argues that about 25 could be expected to have died during the first 10 days, another 25 during the subsequent 10 days, and so on. She makes the point that this regular distribution of fatalities through the 40-day search period would result in a scavenger removal rate that really is less than it would be had all 100 fatalities occurred during the first day of the 40-day term. Looking more closely at this example, as it would apply to the Oregon study from which it was derived, we should expect 80% of the first 25 fatalities caused during the first 10 days to have been removed by scavengers by day 40, leaving 5 carcasses to be discovered. Because cumulative scavenger removals typically progress as a power function of the number of days since the start of the trial, we should expect the first few days to account for most of the removals and for the fitted curve to trend toward its asymptote quickly. Therefore it would be reasonable to expect the second set of 25 fatalities during 11 through 20 days into the 40 day term to leave only about 7 carcasses for discovery at day 40. Although we don't know this would be the case, it would be reasonable to expect about 10 of the third set of fatalities to remain to the end of the 40 day period, and of the fourth set of fatalities caused during days 31 to 40, we might expect to find about 13 on day 40. In total, this exercise would result in 65% carcass removal by day 40, instead of the 80% figure Smallwood and Thelander assumed. However, Smallwood and Thelander applied this carcass removal term not to a 40-day term at Stateline, Oregon, but rather to a 53-day term in the APWRA where 20 years of operations have enabled local mammalian carnivores to learn how to exploit a regular food supply. (Fatality search crews and others affiliated with the research project routinely observed coyotes, red fox and gray fox patrolling wind turbine strings, and there were also American badger and other mammalian carnivores around to remove turbine-killed birds at relatively high rates.) Their assumption that 80% of the small bird carcasses would have been removed is more reasonable. Their assumption was supported by the report of carcass removal from the Tehachapi WRA, where Anderson et al. (2004) reported 96% of hand-placed bird carcasses were removed in 8 days. The Tehachapi WRA is another relatively long-running wind farm where mammalian carnivores have had ample opportunity to learn to exploit the regular food supply around wind turbines. Even if Smallwood and Thelander's assumption was incorrect, it is doubtful that it was incorrect to the degree that the overestimations would have been *gross*, as Weisskopf suggested. It should be noted that the industry's consultants, WEST, Inc., were principal investigators in both the Stateline and Tehachapi studies cited above.

CW-10: An additional potential bias in the second turbine set is related to the difference in seasonal mortality. This portion of the study took place from November 2002 – May 2003. Winter, the season of highest avian mortality found, was considered to be November 16 through the end of February. If the search frequency graph accurately depicts the second turbine set, searches should have taken place between approximately January 1st and mid-March. The vast majority of carcasses found would thus have died during the winter. Two outcomes could arise from this – either the finding of significantly higher winter mortality is an artifact of studying the second set of turbines, or the annual mortality for the second turbines projected from these data are overestimated by concentration of searches covering the winter period.

Staff Response: Weisskopf points out that the second set of turbines was searched largely over the winter and therefore may have resulted in an inflated mortality estimate is exactly the same point already made by Smallwood and Thelander (2004) in their first paragraph of the Discussion section in Chapter 3, which presents the mortality estimates. See Staff Response CW-7 for the paragraph.

Bird use by most raptors in the Altamont Pass is considerably higher during the winter months (see examples in Figure below). Therefore, it stands to reason that this higher bird use would result in greater risk for collision during this season.



CW-11: The matter of search interval for the second turbine string is also puzzling. Although access to the original raw data has not been granted, making data analysis difficult, one assumes that the strings searched for less than 0.5 years on the graph depicting number of searches and searches per year represent the second turbine set. From graph A, it appears as if they were searched twice. From graph B, the lowest number of searches per year for that turbine set was 6, so there must have been about 2 months (61 days) between those two searches. The highest number of searches per year for that set was approximately 9.5, so for those strings the search interval was about 38 days. This implies the search interval was 38 – 61 days for these strings, not the 90 days given for the second set of turbines. A 90-day search interval should show up on graph B around 4 searches per year. There may be several reasons for this discrepancy, including: 1) the second set of turbines was not depicted in these graphs, and there is yet *another* set of turbine strings searched for less than 4 months; 2) the graphs are incorrect; 3) the calculated search interval (and thus the correction for scavenging) is incorrect.

Staff Response: We do not understand the comment, nor do we know which graph Weisskopf finds puzzling. Reference to "graph A" and "graph B" is too vague for us to figure out which graph is under discussion. Weisskopf appears to speculate on how the study was performed, but we suggest it would be more helpful to contact the authors and ask about their methodology. Also, while Weisskopf provides 3 potential reasons for the stated discrepancy, a fourth may be that she is not properly interpreting the graphs. The statement that access to the raw data has not been granted is undeniably false. The raw data were provided to Weisskopf the same day it was requested.

CW-12: These avian fatality data have not been evaluated for population-level effects either in the original publication or by the California Energy Commission. It is difficult to determine the extent of effort that should be required to mitigate an impact of unknown biological significance, particularly without confidence in the mortality estimates. But, regardless of the number of birds killed or not killed, there needs to be certainty that any mandated measures for reduction of mortality will be efficacious, particularly for measures whose implementation is liable to be costly.

Staff Response: As Smallwood and Thelander (2004) honestly stated, they lacked the information they needed to assess population and hence biological impacts of wind turbine-caused mortality. Weisskopf should understand the nearly impossible logistics associated with performing a population assessment of several different raptor species migrating from numerous populations as far north as Canada. Staff is unaware, however, with any other single, regional source of fatality as great as the APWRA. Neither Smallwood and Thelander (2004) nor the Energy Commission staff have mandated any measures; staff have only recommended implementation of mitigation measures in order to test their effectiveness. Staff's goal is still to lower impacts to avian mortality, while allowing for wind development.

CW-13: Many previous efforts in mortality reduction, such as perch guards and blade tip painting, have proven ineffective; there are conflicting opinions on the efficacy of the rodent control program. Although there are predictions of mortality reductions of up to 40% for a suite of measures suggested for the APWRA, few of them have been tested and their effectiveness remains largely hypothetical.

Recommended mortality reduction efforts fall into two areas: modification of the environment and modification of the turbine including turbine operation. Environmental measures include elimination of the debatable rodent control program, removal of rock piles, exclusion of cattle, reduction of vertical and lateral edge in slope cuts and roads, elimination of rodent burrowing under turbine pads, installation of flight diverters, bringing power poles up to APLIC standards and offsite conservation easements. To these are added removal of defunct meteorological towers and moving parts and equipment away from turbines. Of these remedies, meteorological tower removal, particularly of guyed towers, and bringing power poles to APLIC standards are of known efficacy and should be instituted. Although they will reduce avian mortality from wire strikes and electrocutions in the APWRA, they are unlikely to affect turbine-related avian mortality.

Proposed flight diverters are described as either poles placed beyond the end turbine in a string or removal of the turbine from the end tower in a string. This could serve to divert birds around the end turbine, identified as more hazardous to birds than interior turbines. A cautious approach to the installation of flight diverters is justified, as improper placement could divert birds into rather than away from the turbine. In addition, it has been suggested that active turbines next to derelict turbines have higher avian mortality; this effect may also apply to bird diverters whether they are poles or turbine towers, increasing rather than decreasing mortality at end-of-string turbines. The remaining environmental alterations are assessed as having medium to low impact on the mortality of selected species, except for high estimated mortality reduction for burrowing owls from movement of equipment and grazing management.

Modification of the turbine or its management to reduce mortality includes: removal of derelict turbines, relocation of turbines identified as dangerous, movement of turbines to form 'wind walls' and blade painting. Although not expected to have a direct impact on avian mortality, installation of monitoring equipment to record when each turbine is operating, compilation of these operational data, and installation of accelerometers to detect turbine blade strikes are also suggested to improve mortality investigations. To these measures are added permanent shutdown of some turbines, seasonal shutdown of all turbines and repowering of the APWRA.

Blade painting, as described by Hodos, would be investigative in nature, as would be installation of monitoring equipment and accelerometers. These are of uncertain utility, practicality, and/or effectiveness for mortality reduction, and should be neither mandated nor discouraged.

Staff Response: Although mitigation measures have been tried in the past, staff did not find that they have been tried using a large enough sample size to show whether they could be effective, or they were not studied and reported on after they were put in place. Due to this lack of data, no conclusions can be drawn about what may or may not work.

Smallwood and Thelander's recommended measures based on fatality associations derived from scientifically defensible data. Smallwood and Spiegel (2005a,b,c) and Smallwood (2005a,b) provided quantitative assessments of recommended mitigation measures. These assessments were provided to the operators to help narrow down the list of mitigation measures to those that seemed to have the most promise towards reducing blade strikes. Contrary to the impression given by Weisskopf, there is much more foundation to the CEC-funded mitigation recommendations than there was to the previous measures implemented by the turbine owners.

It appears that Weisskopf is arguing that because the effectiveness of mitigation proposed is unknown, nothing should be done. We disagree and recommend that the measures with the most promise be implemented on a scale large enough to test for effectiveness. All mitigation measures ever proposed have an uncertainty factor and must be implemented to be tested. Common sense dictates that some, such as seasonal shutdown during the period of highest bird use placing blade heights above the most frequently used flight zones, will likely have a greater impact on reducing blade strikes.

CW-14: Shutting all turbines down in the fall and winter is projected to reduce mortality for selected species by 44 – 59%, while a winter-only shutdown is projected to reduce avian mortality by 29 – 47%. This proposal arises because studies have found that seasonal avian mortality is not correlated with wind or power production. Smallwood and Thelander found the season of highest avian mortality (approximately 35%) to be winter, and Hunt found golden eagle mortality to be 36% in fall and winter combined, rather than the 20% predicted from seasonal power production data. The projected reductions in mortality assume that *no* birds are killed by non-operating turbines. Therefore, 100% of turbine-related fatalities are presumed to be caused by blade strikes, despite the lack of scientific evidence to support this conclusion and the extensive literature on avian mortality caused by collision with buildings, communication towers, smokestacks, telephone poles, fence posts and other impediments. Neither Smallwood and Thelander nor Smallwood and Spiegel comments on potential causes for this unanticipated winter mortality; Hunt provides some thoughts while acknowledging that they are speculative. Since this significant and unexpected difference in seasonal mortality is not understood, one would hope that the hypothesis that non-operating turbines have no associated avian mortality is thoroughly tested before prescribing it as a mitigation measure for the entire APWRA or for other resource areas.

Staff Response: In attempting to cast doubt on the efficacy of the proposed winter-time turbine shutdown, Weisskopf claims that there is an extensive literature on birds running into tall structures, suggesting that non-operating wind turbines will continue to kill birds. Staff has not found in the literature a source that reports golden eagles, red-tailed hawks, ferruginous hawks, barn owls, or great horned owls running into stationary tall structures. The extensive literature she refers to applies to migrating songbirds on the eastern seaboard of the US, and does not apply to the APWRA. Raptors are agile flyers with keen eyesight, and it is not common for them to run into stationary objects. Moving objects such as turbine blades and vehicles, however, are a well known fatality source for raptors.

Weisskopf states, “This proposal [to shut down turbines during the winter] arises because studies have found that seasonal avian mortality is not correlated with wind power production.” In fact, see Figure 1 below for evidence that avian mortality is indeed correlated with power production during most of the year (using 1999 data from the APWRA in this case, which corresponded with the middle portion of Smallwood and Thelander’s study). And see Figure 2 below for evidence that the correlation between burrowing owl fatalities and power generation does not matter to the conclusion that a winter-time shutdown would make sense for burrowing owl.

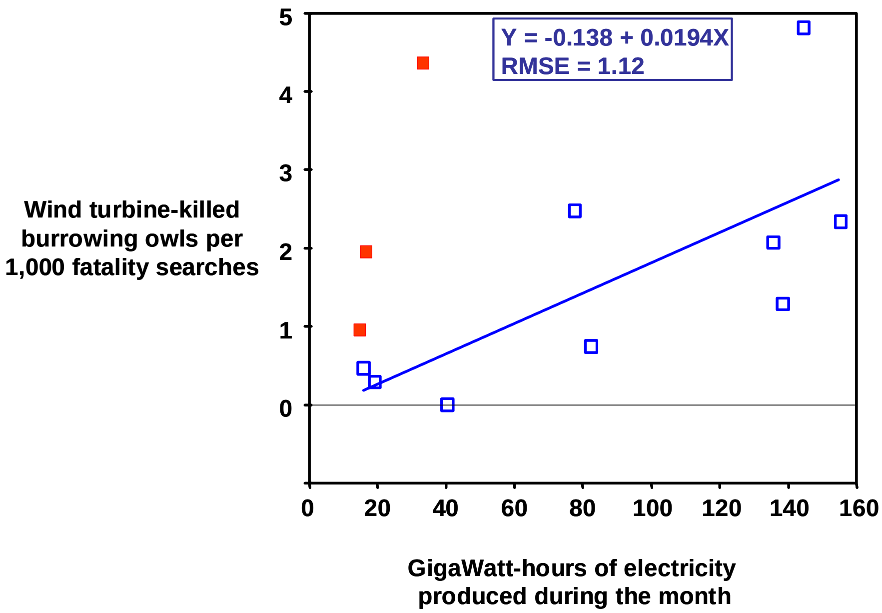


Figure 1. The number of burrowing owl deaths per month as a function of power output in the APWRA, where the filled red squares represented December, January and March and were held out of the analysis as outliers. RMSE stands for root mean square error, expressing the percent error in the raw data. Generally, wind-turbine caused burrowing owl fatalities increased with energy generation ($r^2 = 0.51$, d.f. = 1, 8, $P < 0.05$).

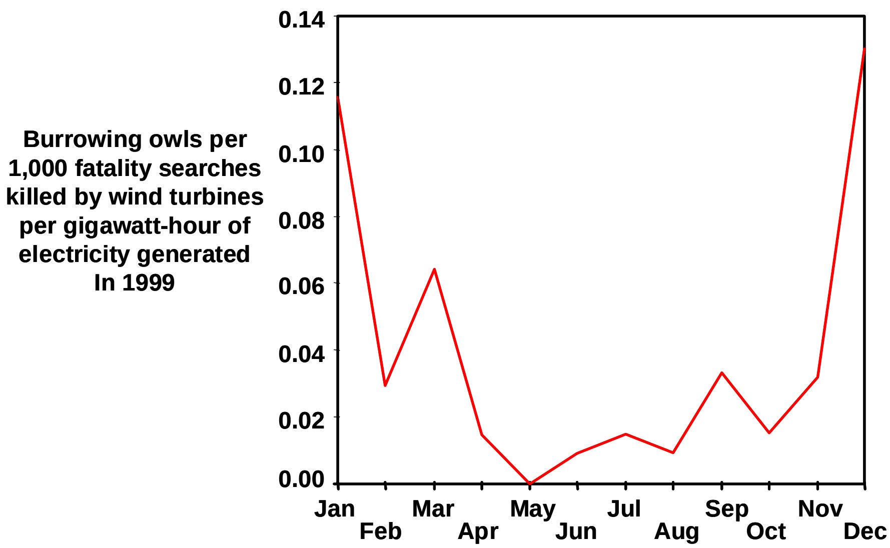


Figure 2. Monthly variation in the ratio of wind turbine-caused burrowing owl fatalities to power generation, showing the owls killed per 1,000 searches per gigawatt-hour peaks during winter and March.

Finally, we note that the proposal to shut down wind turbines during the winter originated with the turbine owners. Smallwood and Spiegel (2005a,b,c) and Smallwood (2005a,b) assessed the likely effectiveness of the owners' proposed measure, and also endorsed it, but we did not come up with the proposal to implement it.

CW-15: Removal of derelict turbines reduces opportunities for avian collision, and should be supported. For permanent shut down of turbines without removal, the possibility of collision mortality remains. Both permanent shutdown and movement of 'dangerous' turbines would be costly, but perhaps justified if high confidence was placed in the model identifying them and in the underlying mortality data used to produce the model.

Staff Response: Weisskopf is incorrect in her implication that mortality data underlies the predictive models presented in Smallwood and Thelander (2005). Mortality data were not used, but rather fatality data. The distinction between fatality and mortality is important in this case. As it relates to bird collisions with wind turbines, mortality is the rate of fatalities per MW (or per turbine) per unit of time. Mortality effectively hides sample sizes, which matters if sample sizes are small and based on differential sampling effort. Mortality estimates inherently represent the statistical population in tests of treatment effect using Analysis of Variance (ANOVA) or of response to changes in continuous variables using correlation analysis, and its use in either of these families of tests requires that certain assumptions are met. These assumptions include independence of observations, the study units were sampled randomly, homogeneity of variance, and normally distributed error terms. Because statistical tests comparing wind turbine-caused mortality in the APWRA cannot come close to meeting these assumptions, especially because Smallwood and Thelander were not given unrestricted access to the APWRA, there is no point in using mortality to test hypotheses in ANOVA or correlation analysis.

For these reasons, Smallwood and Thelander compared frequencies of fatalities among categories or levels of turbine attributes and environmental variables in chi-square tests. Their use of fatality data in chi-square tests more closely met test assumptions because this family of tests is sample-specific. The extent to which inferences can be drawn from results of these tests depends on the sample sizes, the proportion of expected cell values greater or equal to five, and the P-value, and all of this information was provided by Smallwood and Thelander (2004) so that the reader can decide whether and to what extent to draw inferences. (However, inference is also limited by whether the scale of sampling was appropriate to the study unit, and by the levels of replication and interspersion of treatments, and these study design elements have to be described in the methods section of the report in order to help the reader asses the results.)

In relating bird collisions to turbine and environmental variables, Smallwood and Thelander (2004) purposefully avoided using mortality as the test metric, and instead relied on comparing frequencies of fatalities in chi-square tests. Mortality estimates are useful for informing the regulatory agencies and the public about the magnitude of environmental impacts of wind farms, and in comparing impacts between wind farms, but unless much larger sample sizes are collected, compared to what has been collected thus far, they are not useful for developing predictive models of risk posed by wind turbines.

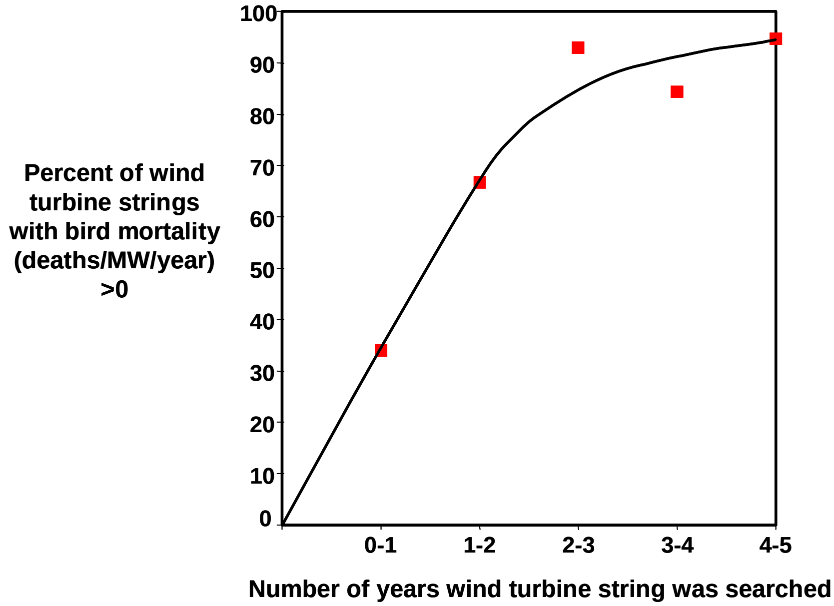
It is important to understand that Smallwood and Thelander's (2004) mortality estimates were not the basis of their predictive models of threat posed to birds by individual wind turbines. Shortfalls in study design, analysis or results interpretation as they relate to mortality estimates do not necessarily relate to fatality associations, which were the main objective of the study. Likewise, shortfalls in study design, analysis or results interpretation as they relate to fatality associations do not necessarily relate to mortality estimates.

CW-16: There should be concern about the assumption that repowering of the APWRA will result in significantly reduced avian mortality. Previous assumptions about tubular vs. lattice towers, upwind vs. downwind rotors, and elimination of perching on nacelles have since been disproved and should be cautionary. Smallwood and Thelander reported that raptor mortality estimates in the APWRA, with its older turbines, were equivalent to those of modern parks when mortality was adjusted for relative raptor abundance. The unexpected avian and bat mortality estimated to occur at the Solano County wind resource area, populated with modern turbines, provides additional evidence that repowering may not solve the problems in the Altamont.

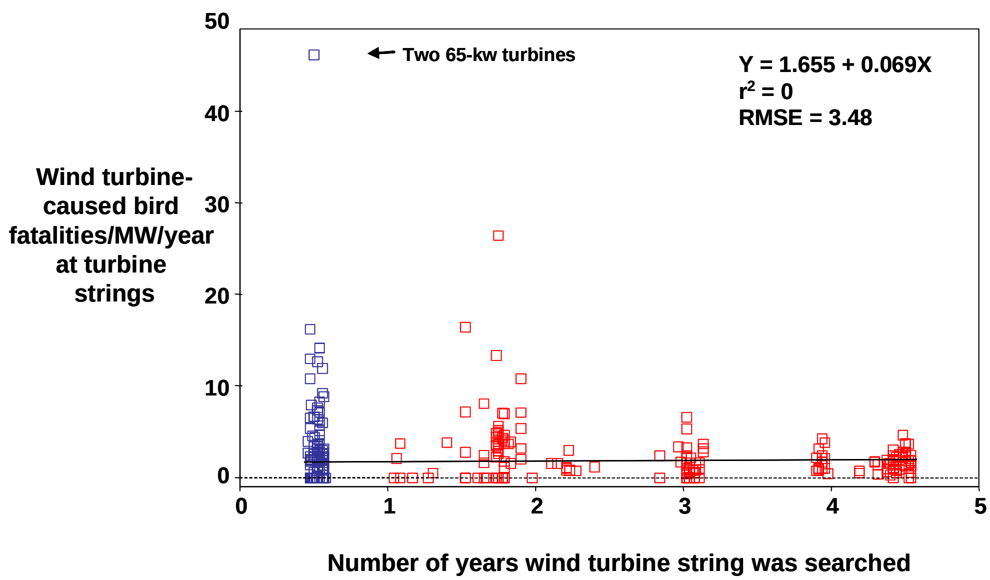
Staff Respones: Weisskopf's cautionary statement about expecting repowering to significantly reduce avian mortality mirrors the cautionary statement made by Smallwood and Thelander (2004). However, they recommended *careful* repowering, siting new turbines where fatality associations and flight behaviors suggest birds will encounter wind turbine blades less frequently. Previous assumptions about tubular vs. lattice towers, etc., were just those, assumptions. Study directed at better understanding those assumptions have now been performed (Smallwood and Thelander 2004, 2005; Anderson et al. 2004, 2005). Repowering at the Altamont should also be studied. We agree that large turbines at Solano County are not the appropriate answer to solve the bird problems there. Smallwood and Thelander made no claims to that effect and in fact specifically directed their recommendations to the Altamont Pass as the title of the study "Developing methods to reduce bird mortality **in the Altamont Pass Wind Resource Area**," indicates. Developing methods to reduce bird mortality at other wind resource areas requires similar study to determine bird behavior and casual factors associated with turbine strikes.

CW-17: In considering enacting recommendations or policy decisions for the Altamont Pass or for other wind resource areas, one should consider what is and particularly what is *not* known about avian interactions with wind turbines, and recall that in the APWRA a 71% reduction in estimated golden eagle mortality and a 100% reduction in estimated ferruginous hawk mortality could be achieved simply by omitting the second, flawed, turbine set.

Staff Response: See response to Comment CW-6. Smallwood and Thelander (2004) were up-front about the differences in Set 1 and Set 2 turbine fatalities. We agree that having access to the Set 2 turbines early and having more survey time on this set would enhance the results. Smallwood and Thelander stressed the need to have 3 years of monitoring data to make reliable estimates on mortality. The graphic below shows that less than 3 years of surveys likely under-represented the number of wind turbines associated with golden eagle and ferruginous hawk fatalities than if access had been granted sooner. The location of the Set 2 turbines was in an area identified by Hunt (2002) to have higher golden eagle use, and the type of turbines in Set 2 were considered more dangerous to golden eagles by Orloff and Flannery (1992, 1996). Therefore it stands to reason that these turbines would have a higher fatality rate than Set 1.



Fatality searches rapidly convert wind turbines in the 0-fatality category to the fatal turbine category through three years.



Study duration improved the precision of the mortality estimate through three years, while the mean mortality estimate did not change.

Removing the fatalities from the second set of wind turbines sampled would indeed reduce their golden eagle and ferruginous hawk **mortality** estimates, but not necessarily the **pattern of fatalities** among categories or levels of each environmental variable, which is what was used to determine risk factors. However, the fact remains that we found more golden eagles and ferruginous hawks among the turbines in Set 2 in four months than we did among 1,525 turbines in Set 1 during the entire 4 years they were searched.

There are two issues at hand, location and turbine type – both critical factors in the Set 2 turbines with regard to golden eagle risk. Excluding Set 2 turbines would have drastically underestimated mortality rates. Yet Weisskopf advocates that approach without pointing out that fact.

Response to CalWEA and KWEA Comments Received on the Assessment of Avian Mortality From Collisions and Electrocutions (Avian White Paper) August 30, 2005

WRITTEN COMMENTS

All comments are verbatim from the CalWEA and KWEA comment letter

Responses provided by Commission staff and Dr. Smallwood lead author of *Developing Methods To Reduce Bird Mortality In The Altamont Pass Wind Resource Area.*

CalWEA/KWEA-1: The wind industry generally, and CalWEA in particular, recognizes that wind-related avian fatalities is an important issue and that the wind industry needs to take appropriate and substantial measures to address it. However, mitigation (and litigation) must be based on sound science if these measures are to significantly reduce fatalities while enabling wind energy to contribute to the state's clean energy goals and thereby deliver the significant environmental benefits noted in the EPR. These benefits include electricity with very limited impacts on California's air and water resources and limited impacts on land use…

These flawed reports threaten to damage the wind energy industry throughout California – and potentially the achievement of the state's RPS goals – while offering very little in the way of proven techniques for reducing avian fatalities.

Staff Response: The mitigation measures proposed for the Altamont Pass Wind Resource Area are based on 4-5 years of rigorous research and sound study design at the Altamont Pass Wind Resource Area. This study represents the most comprehensive research on avian mortality at a wind resource area to date. Dr. Smallwood has extensive experience in study design, statistical analysis, and data interpretation (see Attached CV). Mitigation measures widely used to reduce significant impacts to biological resources from various development practices are rarely based on the extraordinary level of science used to develop measures for the APWRA. More study is always useful, but the impacts to birds from operations at the APWRA have continued since its existence and there is now enough sound science to begin implementing measures to reduce this impact. As stated in Smallwood and Thelander 2004, these measures must be monitored to determine effectiveness. More study in lieu of implementing and monitoring mitigation measures will only lead to continued bird fatalities.

In regards to the statement "These flawed reports threaten to damage the wind industry throughout California – and potentially the achievement of the state's RPS goals - while offering very little in the way of proven techniques for reducing avian fatalities.", the study by Smallwood and Thelander (2004) was conducted to better understand factors associated with bird fatality and use that information to develop mitigation measures. The study did not look at the effectiveness of those techniques, which is the logical next step. Indeed, ignoring the problem, which has led to litigation by private organizations, threatens meeting the RPS goals.

The stated intent of staff is to develop solutions to the serious avian fatality issue at Altamont and to enable the projected expansion of wind energy in California.

CalWEA/KWEA-2: The wind-related mortality figures stated in the EPR and supporting documents are inaccurate, misleading and inflammatory. Wind-related avian mortality should be placed in the proper context as a small part of the overall avian fatality problem.

Staff Response: The mortality figures in the EPR were based on five years of data collection in the APWRA, consisting of 32,439 fatality searches and amounting to the largest data set of avian fatalities in any wind farm in the world. Placed in proper context, wind-turbine caused fatalities contribute cumulatively to all human-caused mortality.

CalWEA/KWEA-3: The EPR's suggestion that the Migratory Treaty Bird Act should be used as a tool to reduce fatalities is inappropriate. The U.S. Fish & Wildlife Service works with industries to reduce mortality before pursuing criminal prosecution. This is especially relevant to wind-related avian fatalities, given the larger context.

Staff Response: The MBTA is not a tool, it is a law. The avian fatalities at wind farms are a violation of this law, and therefore, should be avoided or at least reduced to any extent possible. During several meetings among the US Fish and Wildlife Service, Altamont operators, and CEC staff, the Fish and Wildlife Service repeatedly stated that the MBTA would be enforced if something was not done immediately to reduce current levels of fatalities at the APWRA.

CalWEA/KWEA-4: Contrary to EPR statements, avian issues do not constitute a "serious constraint" to wind development outside of the Altamont. This faulty premise underlies EPR proposals for the development and imposition of statewide standards and the imposition of (untested) mitigation measures.

Staff Response: Avian issues in fact have been a serious constraint to expanding energy output at the APWRA since 1989. In addition, other wind farm developments in California and elsewhere have either been denied or development delayed as a result of avian issues. The National Wind Coordination Committee produced a document (Anderson et. al.2001) specifically stating that avian issues must be confronted early in order to avoid delays.

Following are several current examples of litigation occurring and of delays in permitting projects by the local agencies due to avian mortality issues:

- Pine Tree in the Tehachapi Wind Resource Area is currently being litigated
- Altamont Pass Alameda County permit renewals are being challenged in court

- Shilo I in the Solano County Wind Resource Area was required to redo the CEQA environmental documents and include information on bird mortality from the High Winds project
- Buena Vista in Altamont Pass Contra Costa County was required to move from a mitigated negative declaration to an environmental impact report which delayed the project.
- Several years ago a project in the Tehachapi was also not permitted due to concerns about California condors.

CalWEA/KWEA-5: The Smallwood/Thelander Report (and statements in the EPR and Avian Assessment that rest on this report) should be rejected as a basis for any statements and recommendations in the IEPR. Further, the Commission should take steps to prevent its misuse as a basis for policy making, litigation, and public perception.

Staff Response: We strongly disagree. The Energy Commission and NREL have been studying the avian issue in California since 1989 and have produced numerous studies on this issue. The research results are intended to guide policy decisions and further the advancement of wind development in a biologically sound manner. CalWEA does not provide any science to dispute the research results and therefore the basis for this comment is not supported.

CalWEA/KWEA-6: The Commission should subject the Smallwood/Thelander Report to an independent review of its scientific validity, as well as to public review, which has not occurred. If methodological errors and unsubstantiated conclusions are found, the Commission should institute protocols to ensure that such problems do not occur in the future.

Staff Response: The claim that industry and public review did not occur is incorrect. The Smallwood and Thelander 2004 report was provided in draft form to all operators at the APWRA, U.S Fish and Wildlife Service, California Department of Fish and Game and Alameda County, prior to release. All on the recipient list were encouraged to distribute the report to other interested parties related to the wind operators. As a matter of fact, once it was known that the draft report was released to the operators, we received several requests, including a request form the Center for Biological Diversity and other environmental groups to release the report to them also. These requests were denied as a courtesy to the wind operators at APWRA. Very few comments were received (3 written and 1 verbal) and all comments were addressed in response letters. The list of those who received the document in advance of release for further peer review includes:

Rick Koebbe, President PowerWorks Inc.
Willaim Damon Vice President PowerWorks, Inc
Robert Szymanski, Vice President PowerWorks, Inc
Steven Steinhour, Vice President SeaWest
Steve Ponder, Vice President Florida Power and Light
Joan Stewart Permits and Environmental Affairs Florida Power and Light

Jim Lindsay, Florida Power and Light
Tara Dinman, Florida Power and Light
Rebecca Perree. Florida Power and Light
Rich Piper, Florida Power and Light
Ed Taylor, Project Manager Global Renewable Energy Partners
George Hardie, Owner G3 Energy
Eric Newell, Enron
Jeff Welton wintec energy
John Schwartz, Silcon Valley Power
Kelly Lard, Enxco
Dale Strickland, WEST, Inc
Wally Erickson, WEST, Inc
Darryl Gray Assistant Planning Director Alameda County
Andrew Young, Planner Alameda County
David Brockbank, Contra Costa County
Scott Heard Resident Agent in Charge, U.S. Fish and Wildlife Service
Larry Butcher, U.S. Fish and Wildlife Service
Janice Gan, California Department of Fish and Game
Ron Jurek, California Department of Fish and Game
Sarah Calzada, California Department of Fish and Game.

After those identified above reviewed the document, it was sent out for peer review to independent scientists including Richard Anderson, Susan Orloff, and David Sterner. In addition, many research papers are now being prepared for submittal to scientific journals and will receive further peer review as normal procedure.

Furthermore, Smallwood and Thelander (2005), which is similar in size and scope to the CEC-funded report, was also subjected to independent review by three scientists, and this review benefited both reports.

CalWEA/KWEA-7: The Commission has a responsibility to ensure that all of the data from the Smallwood/Thelander Report are immediately released to the public. (Contrary to standard practice in publicly-funded studies, only a portion has heretofore been released.)

Staff Response: All CEC data have been released upon request, including a request from CalWEA and KWEA (data provided the same day of the request [July 8, 2005]). Data controlled by NREL must be released by NREL, not CEC. This was made explicitly clear to CalWEA when their data request was made.

CalWEA/KWEA-8: Biological significance has not been shown either by the Smallwood/Thelander Report or by the Energy Commission. This has important implications for the Commission's recommendations regarding mitigation and other policies. Biological significance cannot be judged by lack of compliance, or indeed, compliance with, the Migratory Bird Treaty Act or even the Endangered Species Acts.

Staff Response: Showing biological significance of the fatalities in the APWRA was beyond the scope of study of Smallwood and Thelander (2004). A disproportionate number of the fatalities in the APWRA occur during winter because bird use in the APWRA is high during winter by birds migrating from several other areas outside the APWRA. Determining effects on populations would require extensive studies of regional populations from many regions, including many other states and Canada. Because of annual fluctuations in species populations, multiple regional considerations and study requirements, costs, and various other difficult logistics associated with conducting such time-consuming and regionally extensive studies, it is very difficult to conduct population-level analysis. For species such as golden eagle and burrowing owl that are year-round residents with many fatalities occurring in the off-winter months, PIER has invested or intends to invest research funds to answer this question. Please see Hunt (1997; CEC Report P500-02-043F) as an example. Smallwood and Thelander (2004) provided discussion of the magnitude of fatalities in the APWRA, and pointed out, for example, that the annual number of golden eagles killed by wind turbines in the APWRA is about 50 times greater than the number of eagles that can be supported by the habitat area in the APWRA.

The fact that biological significance at the population level is uncertain is rather unimportant when considering the level of fatalities associated with wind turbines alone. There is not another single source of mortality documented in a regional area in California that is as high as wind turbine-related mortality in the APWRA. Collisions with buildings, towers, etc. have been documented on a nation-wide basis (Erickson et al. 2001); however, this citation compared various sources of avian fatality using confounding and disparate study designs. Further, issues such as collisions with buildings and towers and cat predation are problems in of themselves and should be viewed as further cumulative impacts to bird populations and dealt with independently.

CalWEA/KWEA-9: Proposed mitigation measures, including winter shutdowns, are based on underlying assumptions that have not been subjected to peer-review, let alone proven. Compounding this problem is a lack of understanding of the potential causes of mortality. Were these untested mitigation measures to be imposed, they would be unlikely to produce the projected reductions in mortality while imposing significant costs on the industry. Therefore, Commission adoption of such recommendations prior to establishing a sound scientific basis would be reckless.

Staff Response: We disagree that use of such a large and thoroughly analyzed data set as gathered by Smallwood and Thelander (2004) is “reckless” in assessing potential mitigation measures. Indeed, doing nothing to mitigate the avian collisions since the problem was first identified in 1989 could be viewed as reckless. All mitigation measures widely implemented to reduce biological impacts are based on the best available science and most often, no science, but on best guesses based on what is known. The mitigation recommended in Smallwood and Thelander are in fact based on 4-5 years of scientific data accumulation and analysis, the most ever gathered from a single wind farm site. CalWEA does not provide any science to refute the data or provide better data. There is little doubt that shutting down turbines will result in fewer collisions with moving blades. Seasonal shutdown during the season of greatest collision will undoubtedly reduce collisions. However, we agree that mitigation measures must be monitored to determine the magnitude of reduction.

The wind turbines owners themselves proposed a wintertime shutdown measure in a December, 2004 draft of their plan, and they later proposed a partial wintertime shutdown in their February, 2005 draft plan. The industry has yet to disclose what financial hardship would be imposed upon them by implementing this measure despite repeated requests by Alameda County and the state Attorney General's Office, therefore we cannot respond to this portion of the comment.

CalWEA/KWEA-10: The Buena Vista repower project may have trouble maintaining its financing and getting built given the current climate of litigation -- litigation that enlists the conclusions of the Smallwood/Thelander Report -- and regulatory uncertainty. The permits for this project incorporate many of the latest Smallwood/Thelander Report recommendations. The project's future operation is widely viewed as an important test of these new measures over the next three years.

Staff Response: We cannot speak for Buena Vista in regards to obtaining financing. Buena Vista incorporated many recommendations by Smallwood and Thelander 2004 and received permits to repower without legal challenge and we are unaware of any pending litigation. Therefore, we do not understand the basis of this comment and instead view the Buena Vista repower project as proof that showing due diligence in regards to implementing sound mitigation measures reduces the potential for litigation and facilitates the permitting process.

CalWEA/KWEA-11: There is no need to "confirm" low mortality in Tehachapi, Pacheco and San Gorgonio. If additional studies are conducted, appropriate methods must be used; the methods currently being employed by Commission-funded consultants require peer- and public review. The Commission ought not to expend resources when there is no evidence of a problem.

Staff Response: CalWEA and KWEA express a double standard with regard to the need for peer review. They claim Smallwood and Thelander (2004) is in desperate need of peer review, but then imply that the research leading to the reports of bird fatalities at Tehachapi and San Gorgonio is not. We note that the Smallwood and Thelander (2004) report was based on nearly 1,200 fatalities after 32,439 fatality searches among 4,074 wind turbines, whereas the Tehachapi and San Gorgonio reports were based on 127 and 92 fatalities, respectively, after an unreported number of fatality searches among 201 and 238 wind turbines. The sample size differences are dramatic, and the small sample sizes from Tehachapi and San Gorgonio indicated the uncertainty of estimates from those study sites is much larger than at the APWRA. Additional data collected using more rigorous sampling designs would help reduce the uncertainty in mortality estimates and fatality patterns at these other sites.

The need to confirm mortality was based upon a recommendation of the lead author and principle investigator of the Tehachapi and San Gorgonio studies.

CalWEA/KWEA-12: Avian studies and mitigation are being appropriately handled by local agencies in their role as the lead agency implementing CEQA. Contrary to the EPR's proposition that statewide guidelines may be an appropriate way to gain consistency when developing and mitigating projects, environmental assessment is highly site-specific. County-level control of the process is therefore appropriate.

Staff Response: We are unaware of any significant measures other then monitoring (which is not mitigation) occurring at other California wind farms to reduce avian collision. We agree that avian problems are site specific and require site-specific solutions. Statewide guidelines would provide consistent analysis, review and recommendations and reduce fragmented and inconsistent CEQA assessments. Currently, that does not exist and therefore it is difficult to make a statewide assessment. As an example, Washington State has prepared statewide guidelines to support the local permitting process.

CalWEA/KWEA-13: The Commission Should Place The Wind-Avian Problem In Context

a. Wind-related avian mortality is a small part of the overall problem

The EPR states (on p. 3), "California's wind energy farms are killing thousands of hawks, eagles and other birds each year. Thousands more are killed through collision or electrocution with electric power lines." This inflammatory remark fails to put wind-related bird kills in the proper context. While no one disputes that birds are being killed by wind turbines, the U.S. Fish and Wildlife Service (USF&WS) estimates that wind turbines kill an estimated 33,000 birds annually in the U.S., while strikes at communication towers "conservatively kill 4 to 5 million birds annually (possibly closer to 40 to 50 million…)" nationwide. There are, of course, many other sources of bird kills, such as the two million birds killed annually in oil and wastewater pits, mainly in the western states, and the 72 million birds killed directly by pesticides annually.

To put the issue into further context, wind-related avian fatalities would still constitute a tiny fraction of the total even if (a) all of these U.S. wind-related bird kills were assumed to be in California, (b) California expanded its wind capacity four-fold (consistent with Energy Commission scenarios), and (c) the expanded capacity had the same fatality rates as the Altamont (even though virtually all of that development will occur outside of the Altamont, mostly in Tehachapi where avian fatalities are known to be low). In this extreme scenario, wind-related avian fatalities would still constitute a tiny fraction of the total human-caused avian fatalities in the U.S. Again, this is not to discount the wind-related bird-kill problem; but policy makers need to understand the problem in a larger context.

Staff Response: The statement, “California’s wind energy farms are killing thousands of hawks, eagles and other birds each year. Thousands more are killed through collision or electrocution with electric power lines.” is not an inflammatory remark.

The fact that there are numerous other human-caused bird deaths are evidence of cumulative impacts, which should not be used to trivialize the impacts of wind turbines, but rather to heighten our concern for them. Staff is unaware of any other single source of mortality to golden eagle, red-tailed hawk, burrowing owl, and American kestrel than wind turbine collisions. Also, to be put into proper context the bird mortality estimates need to be compared on a common metric, which nobody has done yet. A common metric might be the annual number of birds killed per household or per capita, as examples.

CalWEA/KWEA-14: b. The stated wind-related mortality figure is inaccurate and misleading

The EPR states (on p. 5), “At the Altamont Pass Wind Resource Area in Alameda County, estimates of bird mortality range from 881 – 1,300 raptors and 1,766 – 4,721 total birds killed annually.” These figures, derived from the Smallwood/Thelander Report, are seriously flawed. They should not be repeated in the IEPR. As discussed extensively in the Weisskopf Comments, there are a number of flaws in the methods used to extrapolate from actual carcass counts to the estimated total number of fatalities. The total carcass count under the Smallwood/Thelander study over the entire 4+ years studied was 1,162 birds of all types (about 260/year), of which 519 were raptors (about 120/year). The various extrapolations employed turned 260 carcasses/year into 4,700 carcasses/year.

The mortality range stated in the report is also misleading, because it lumps together protected and “high value” birds with non-native birds and those that can legally be poisoned because they are considered agricultural and environmental pests. Specifically, in the searcher efficiency and scavenging-corrected species estimates, the annual fatality prediction for the European starling (considered to be a non-native pest) is 1,633 birds per year, and the rock dove (pigeon) is 2,527 birds per year. Subtracting these figures from the 4,721 high-end annual fatality total given in the EPR and underlying reports would not be accurate either, however, because the species mortality projections in the Smallwood/Thelander Report are not accurate.

Not only should the Commission not reproduce these misleading and inflammatory numbers in its IEPR report, but it should take steps to remove these figures from its publicly available materials. In addition, the Commission should subject the Smallwood/Thelander Report to peer-review and comment by interested parties. The Commission provided no opportunity for public review and comment on this report at any stage during the process and, although a portion of the Smallwood/Thelander study data was recently released to CalWEA, the majority remains unavailable. The Commission has a responsibility to ensure that all of the data are immediately released to the public.

Staff Response: Smallwood and Thelander originally intended to present mortality estimates only of individual species, and only for those species represented by more than one turbine-caused fatality discovered during the study. The reason they originally restrained themselves this way was because the adjustment factors used to calculate mortality estimates were more reliably applied to species with more than one fatality. (Adjustment factors were made for turbine-caused bird fatalities undiscovered beyond the 50-m search radius, searcher detection of carcasses within the search radius, and the rate of scavenger removal of carcasses.) The smaller the sample size, the more radically the adjustment factors will alter the magnitude of the estimate, resulting in increasingly larger ranges between the low and high adjusted mortality estimates. Therefore, Smallwood and Thelander (2004) chose not to estimate mortality for individual species represented by only one turbine-caused fatality.

Regardless of their original intention, Smallwood and Thelander (2004) pooled all bird species together in one mortality estimate, regardless of their public status, because both the Altamont operators and U.S. Fish and Wildlife Service requested they do so. This 'all bird' estimate was added to the tables of mortality estimates, which listed fatalities and mortality estimates by individual species so the readers can understand exactly the facts behind the numbers – no attempt was made to hide the fact that starlings and rock doves were included in the 'all bird' mortality estimate. Estimates were also added for all hawks and all raptors because it grew clear during meetings with the regulatory agencies and turbine operators at the time that raptors would serve as the target group of species when developing mitigation measures. Indeed, the predictive risk assessment and mitigation measures eventually were focused on fully protected raptors.

Mortality adjustments applied to individual species were readily extended to the 'all hawks' group, because this group was composed of species sharing the facts they were raptors and also categorized as large-bodied (specific adjustments had been made according to these categories when estimating mortality of individual species). Mortality adjustments were extended to the 'all raptor' group nearly as reliably, although this group included two small-bodied raptor species (American kestrel and burrowing owl), which complicated the adjustments. Also, there were some carcasses in this group that could not be identified to species, so the mortality adjustments were more prone to error than they were for the 'all hawks' group. However, Smallwood and Thelander felt confident their 'all raptor' mortality estimates were reasonable.

The 'all bird group' was the most complicated when it came to estimating mortality, especially when it came to applying scavenger rates to adjust the estimates. This group included many more carcasses that were not identified to species, so they were unsure about which of the available scavenger removal terms to apply to this group. Smallwood and Thelander decided to take the mean between scavenger rates applied to the small-bodied and large-bodied species, and then multiply it by 1.5. Thus the scavenger removal terms of 0.198 and 0.414 applied to small-and large-bodied species found among Set 1 turbines were used to calculate their mean of 0.306, which was multiplied by 1.5 to arrive at the ‘all birds’ scavenger removal term of 0.459 for carcasses found among Set 1 turbines. The scavenger removal terms of 0.098 and 0.314 applied to small-and large-bodied species found among Set 2 turbines were used to calculate their mean of 0.206, which was multiplied by 1.5 to arrive at the ‘all birds’ scavenger removal term of 0.309 for carcasses found among Set 2 turbines. The factor 1.5 was used because the smaller scavenger removal rate that had been used on individual raptor species, as well as on the ‘all hawk’ and ‘all raptor’ groups, had not yet been applied to the ‘all birds’ group, nor could it be applied in the straightforward manner it was applied to the other groups (and species).

Smallwood and Thelander’s (2004) scavenger removal rate adjustment to the ‘all birds’ group resulted in a significant deviation from the other low- and high-end estimates calculated for individual species and for the ‘all hawks’ and ‘all raptors’ groups, as well as a deviation from the low-end of the ‘all birds’ group estimate in terms of its magnitude relative to the sum of the species estimates shown in Table 3-11. This deviation resulted from a separate methodology used to arrive at this one estimate, i.e., the high end of the uncertainty range estimated for ‘all birds.’ Another scientifically defensible approach would be to sum the high end estimates among the species shown in Table 3-11, then add to this sum an educated guess of the mortality among species not shown in Table 3-11, including the carcasses not identified to species. This latter approach might yield an upper-range mortality estimate of about 11,000 birds per year in the APWRA. Either approach indicates thousands of birds are killed each year in the APWRA due to wind turbine collisions alone, which was the main point presented by Smallwood and Thelander (2004) regarding the ‘all birds’ mortality estimates.

CalWEA/KWEA-15: There Is No Evidence That Wind-Related Avian Fatalities Are Biologically Significant

As suggested (but not emphasized) in the EPR (at p. 10), wind-related avian fatalities have not been evaluated for population-level effects:

> Wind energy offers tremendous promise as a non-polluting, commercially viable alternative energy resource. Yet impacts to raptors like hawks and eagles continue at *potentially* significant levels” (emphasis added).

As pointed out by Weisskopf, biological significance has not been shown either by the Smallwood/Thelander Report or by the Energy Commission. This has important implications for the Commission’s recommendations regarding mitigation and other policies, as discussed below. It is particularly important in evaluating projects in the context of the California Environmental Quality Act (CEQA), which requires regulatory agencies to impose mitigation measures only for significant effects on the environment and requires those measures to be proportional to the impacts.

Staff Response: We disagree with CalWEA and KWEA over their interpretation of significance under CEQA. Population-level or “biological” impacts need not be proven before significance under CEQA is concluded, based on our understanding of CEQA.

All that is needed for a significant impact under CEQA is for a special-status species to be adversely affected by the proposed project.

CalWEA/KWEA-16: Avian Issues Are a Constraint to Development Only In the Altamont and Do Not Constitute a "Serious Constraint" to Wind Development Statewide

The EPR states, at p. 15, "avian collisions with wind turbines have become a serious constraint to repowering and expansion." This statement is accurate only in the Altamont, and in the Altamont only to a certain extent. As other Energy Commission reports show, the remaining development potential at the Altamont constitutes a very small fraction of the potential generation from wind statewide.

Given this faulty premise, the EPR's conclusion (at p. 15) that "Statewide standards could … remove a significant environmental barrier to increasing wind energy in the state" is inaccurate. Likewise, the EPR statement (at p. 16) that "developing mitigation measures for implementation would allow for continued use of the wind resources in Solano County" implies inaccurately that continued use of the wind resource in Solano is not presently possible, which is at odds with the County's recent issuances of conditional use permits for wind projects. (High Winds Project, 2003, Shiloh I Project, 2005.) It also overlooks the fact that Solano County is already imposing mitigation measures for avian impacts.

Staff Response: Following are several current examples of litigation occurring and of delays in permitting projects by the local agencies due to avian mortality issues:

- Pine Tree in the Tehachapi Wind Resource Area is currently being litigated
- Altamont Pass Alameda County permit renewals are being challenged in court
- Shilo I in the Solano County Wind Resource Area was required to redo the CEQA environmental documents and include information on bird mortality from the High Winds project
- Buena Vista in Altamont Pass Contra Costa County was required to move from a mitigated negative declaration to an environmental impact report which delayed the project.

CalWEA/KWEA-17: Mitigation Strategies Must Be Based on Sound Mortality Research

In certain places, the EPR appropriately indicates that further research is necessary to determine which mitigation measures are effective. Yet, the EPR also states (at p. 16):

> As the next step, industry *needs to implement* and monitor those mitigation measures *Altamont-wide* to determine their effectiveness. Two measures that *would reduce* bird kills by eliminating spinning turbine blades are seasonal shutdown (winter months) or removal of wind turbines in the highest-risk areas."

More generally, the EPR states (at p. 106):

> [S]taff believes the Energy Commission may want to consider various policy options that are included in the 2005 Environmental Performance Report white

paper entitled *Assessment of Avian Mortality from Collisions and Recommendations*.

Except for bringing power poles to APLIC standards and removal of met towers and guy wires, no other mitigation measure listed in the Avian Assessment has been tested and the effectiveness of these measures is therefore hypothetical. Among these, the Avian Assessment (based largely on the Smallwood/Thelander Report and the Smallwood/Spiegel adaptive management plan) contains the recommendation for a winter shutdown. Not only is this measure untested, but as with many other proposed measures, it is based on underlying assumptions that have not been subjected to peer review, let alone proven.

Staff Response: Mitigation strategies proposed in Smallwood and Thelander ARE based on sound mortality research, the most extensive data set ever assembled on wind turbine-caused avian impacts at a single wind farm. The winter shutdown was proposed by Altamont operators (WEST 2004), not staff; however, staff did provide an assessment of this measure and concluded that it would lead to a reduction in avian fatalities. The EPR and Smallwood and Thelander recommend the mitigation measures be tested, but they must be implemented to test them.

Using the CalWEA and KWEA example of APLIC standards to mitigate for bird deaths with power poles, these standards were produced using common knowledge of how birds are electrocuted and were not fully tested prior to being implemented but in fact have now been shown to reduce electrocutions. Common sense dictates that shutting down turbines will lead to fewer collisions with moving blades.

CalWEA/KWEA-18: Figure 2-5 (p. 36) in the Smallwood/Thelander Report – a report described in the EPR as the "most comprehensive study at the Altamont … focused on trying to better understand the causes of bird mortality" (EPR at p. 85) – shows that the number of fatalities in winter and summer in the Altamont Pass are grossly disproportionate (e.g., fatalities in the winter are approximately 2.5 times those in the fall). This conclusion is stated on p. 3 of the Executive Summary as well. Figure 2-5 implies higher winter mortality because it shows that more carcasses were found in the winter. There is a simple possible explanation for this: more turbines were searched in winter than any other season…

Staff Response: The text related to Figure 2-5 in Smallwood and Thelander (2004) simply states that more carcasses were discovered during winter and summer; it does not state that more birds died during winter and summer because that graphic does not incorporate estimated time since death, nor does it factor in search effort made during the corresponding season. The text that cites Figure 2-5 is simply describing when the carcasses were discovered; it was misinterpreted by CalWEA and KWEA. Search effort and time since death are factored into the fatality associations in Chapter 7, which reported disproportionate numbers of fatalities during winter and summer, although there are species-specific differences in seasonal patterns of fatalities. For most species, winter emerges as the most dangerous time in the APWRA, and after factoring in power generation per season, winter emerges as the season when shutdown can minimize power reduction in order to kill disproportionately fewer birds. A wintertime shutdown would reduce annual power generation in the APWRA by 16%, while reducing bird mortality by 2 to 3 times that percentage, depending on the species or group of species examined (see Table below). A wintertime shutdown performs more effectively in reducing bird mortality than does the selective shutdown of the most dangerous wind turbines, but the combination of measures would likely reduce mortality of select raptor species by more than half.

The following table includes results from Smallwood and Spiegel (2005a) and Smallwood (2005).

Species	**Fatality reduction due to shutdown of turbines during the winter**	**Fatality reduction due to shutdown of selective turbines and all remaining turbines during *all* the winter**
Golden eagle	29%	57%
Red-tailed hawk	39%	56%
American kestrel	47%	63%
Burrowing owl	35%	41%
All raptors	37%	54%
All birds	34%	44%

CalWEA/KWEA-19: Further, each season is normally equated with a quarter of the year. But "fall" in the Smallwood/Thelander Report is half as long as winter, so there should be half as many carcasses found during the fall season compared to winter. With the assumed numbers above -- 2 carcasses/search for both fall and winter – fall is two times worse for the birds. No correction was made for season length in the Smallwood/Thelander study.

Staff Response: CalWEA and KWEA are incorrect in their conclusion that Smallwood and Thelander's (2004) tests for association between season and fatalities were flawed for not factoring in season length, which varied. Season length was irrelevant to the tests, which factored in search effort per season. Search effort was factored in as described on page 185 of Smallwood and Thelander (2004):

"Search effort specific to season of the year was calculated as:

$$\text{Season-specific Turbine Search Effort, } Y_{t,s} = (S_s \div S_t) \times Y_t \,.$$

where S_s was the number of searches made at the wind turbine during a particular season and S_t was the total number of searches made at the wind turbine. This search effort was adjusted by the searches during the next season that could document fatalities < 90 days old and that occurred during this season:

$$\text{Adjusted Season-specific Turbine Search Effort} = Y_{t,s} + 0.5 \times Y_{t,s+1},$$

where $Y_{t,s+1}$ represents the search effort at the turbine during the following season. Essentially, we added half of the next season's search effort to the targeted season search effort. The sum of the adjusted season-specific turbine search effort values was divided into the sum of all these values across seasons in order to arrive at a proportion of the total search effort that was made per season across the APWRA."

This weighting of search effort by season was fed back into the model presented earlier on the same page of Smallwood and Thelander (2004:185), but modified here for convenience:

Search effort at the turbine level of analysis was calculated as:

$$\text{Turbine Search Effort} = Y_{t,s} \div \Sigma\, Y_{t,s},$$

and,

$$\text{Incidence, } P_i = \Sigma \text{ (Fatality searches made during a particular season)},$$

and then,

$$\text{Expected} = N \times P_i,$$

where Expected refers to the expected value used in chi-square analysis, and N represents the total number of fatalities compared within the measured set of seasons, i.e., winter, spring, summer, fall.

The duration of season was irrelevant because Smallwood and Thelander weighted search effort by the actual number of searches made per season, which they felt more closely represented the effort made per season.

CalWEA/KWEA-20: Finally, there were two sets of turbines studied. The larger turbine set (2,500 turbines) was never searched in summer at all, yet the fall/winter/spring carcasses were used anyway in the seasonal mortality analysis.

Staff Response: Estimated times since death varied among the carcasses found among these 2,548 turbines, so some fatalities were estimated to have been caused the previous summer or fall, and some during that winter or spring. Furthermore, the tests factored in search effort (see previous response), so it really did not matter that these turbines were searched only during winter and spring. The increased search effort during winter and spring at these 2,548 wind turbines was factored into the test when calculating expected numbers of fatalities per season among all the 4,074 wind turbines contributing to the test.

CalWEA/KWEA-21: When the Smallwood/Thelander figures are appropriately adjusted based on the information on Appendix p. D-21, Figure 2-5 as shown in the Report (recreated below) becomes the figure shown on the next page, and summer replaces winter as the season of highest mortality.

Staff Response: CalWEA and KWEA are correct in their adjustment of Figure 2-5 to the Figure produced on page 9 of their comment letter. Their adjustment corresponds with the results Smallwood and Thelander (2004) show in Appendix D-21. It is satisfying that CalWEA and KWEA came to the same conclusion as Smallwood and Thelander (2004). However, the same adjustment, which we made, produces different results for different groups of species and for individual species. For most species, factoring in search effort reveals the disproportionately greater number of fatalities caused by wind turbines during the winter.

However, a winter-time shut-down makes sense not only for species killed disproportionately during the winter, but also for at least some species killed disproportionately more often during summer, e.g., golden eagle. The proposal first made by the wind turbine owners, and later assessed by Smallwood and Spiegel (2005a,b,c), factors in power output from the APWRA during each season as well. The relatively low power generation during winter can still associate with disproportionately more bird fatalities during winter, even though the particular species of bird is killed more often during peak power generation, in summer. There was no disagreement on this point between the owners' consultants, WEST, Inc. and CEC staff.

CalWEA/KWEA-22: If the assumption that winter is the season associated with disproportionate mortality is wrong, then the predicted reduction in mortality by turning the turbines off during the winter will be wrong, too. Despite the uncertainties inherent in the underlying study, the uncertainty falls away in the EPR, which (at p. 6 and p. 76) states as fact that "bird collisions are highest" in the winter season. The justification for the winter shutdown presumably is this higher winter mortality. Though this justification is not stated in the reports, it was implied by CEC staff at a recent workshop.

Staff Response: CalWEA and KWEA claim Smallwood and Thelander (2004) wrongly assumed that winter-time mortality is disproportionately greater, and therefore the Altamont operator's recommendation of winter-time shutdown and Smallwood and Spiegel's (2005a,b,c) assessments are ill-based. CalWEA and KWEA chose to challenge this assumption as it applies to all birds as a group, whereas Smallwood and Spiegel (2005a,b,c) applied this assumption to golden eagle, red-tailed hawk, American kestrel and burrowing owl; the USFWS and the Altamont operators requested we concentrate our mitigation recommendations to these species. Furthermore, Smallwood and Spiegel (2005a,b,c) factored in power generation, which is low during winter, and clearly indicates winter shutdown would be effective. The assumption that winter-time mortality is disproportionately greater than during fall and spring is supported by the data in most cases, and the application of this assumption, while also considering seasonal variation in power generation, was appropriate, as well as supportive of the owner's own conclusion that winter-time shutdown of wind turbines would be worthwhile.

CalWEA/KWEA-23: Compounding this problem is a lack of understanding of the potential causes of mortality. As pointed out in the Weisskopf Comments, seasonal avian mortality is not correlated with power production (i.e., rotating blades). And yet the Smallwood/Thelander Report assumes, in its projections of reduced mortality from a winter shutdown, that no birds are killed by non-operating turbines, despite the extensive literature on avian mortality caused by immobile objects such as smokestacks and telephone poles.

Staff Response: Staff believes that the risk association with specific turbines would be strengthen if correlated with power production and repeatedly requested the information necessary to perform that analysis from the operators. That information was never received.

There is not extensive literature on raptor mortality with immobile objects – it is a fairly rare event. Raptors have keen eyesight and are very agile flyers. Passerines, however, are known to collide with communication towers, buildings, etc., particularly during mass migrations during inclement weather. In these cases, hundreds of birds may be found underneath the structure just after the weather event. Small birds also collide into windows of buildings, presumably because they do not recognize these reflective, stationary items as structures. Similarly, it is believed that raptors collide with moving turbines blades because they cannot see them until they are too close to avoid them.

Smallwood and Thelander (2004) distinguished death caused by wind turbines from other causes (see Figure 2-2 and Figure 2-3 below). Most carcasses had injuries that could easily be associated with turbine blade collisions, such as severed wings or tail, decapitation, or torso cut in half. A 2003 study conducted by WEST, Inc "Monitoring Studies at the Buffalo Ridge, Minnesota Wind Resource Area: Results of a 4-Year Study" found the amount of natural fatality occurring in their study was too small to warrant attempting to correct for natural mortality. Nor did it warrant the time required to document mortality in control (non-turbine) areas. Studies conducted by Anderson et al. in Tehachapi found those same results.

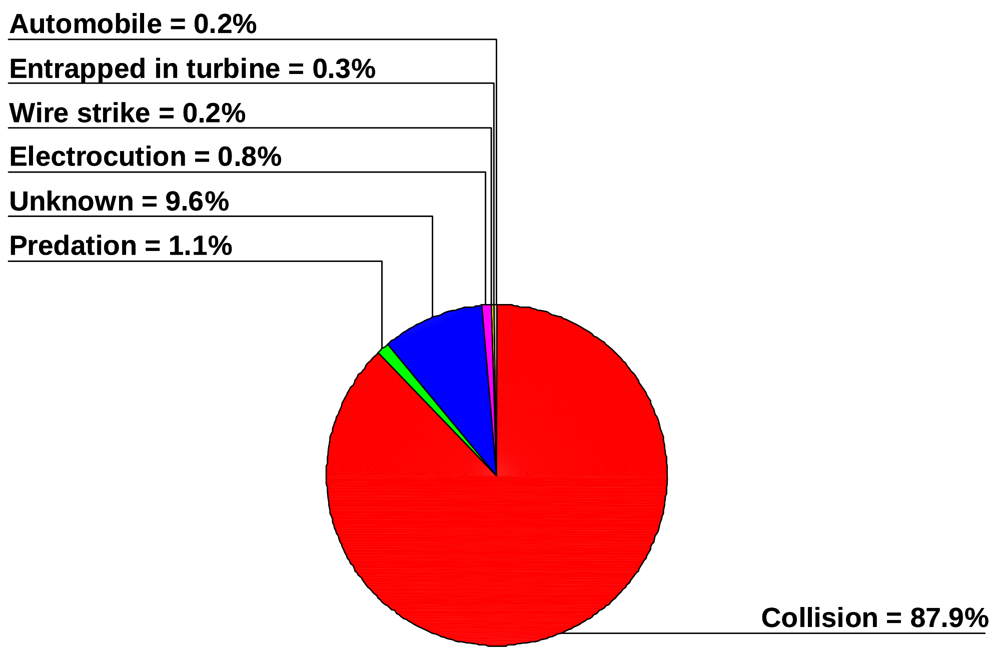


Figure 2-2. Pie-chart distribution of causes of fatalities attributed to carcasses found in the APWRA

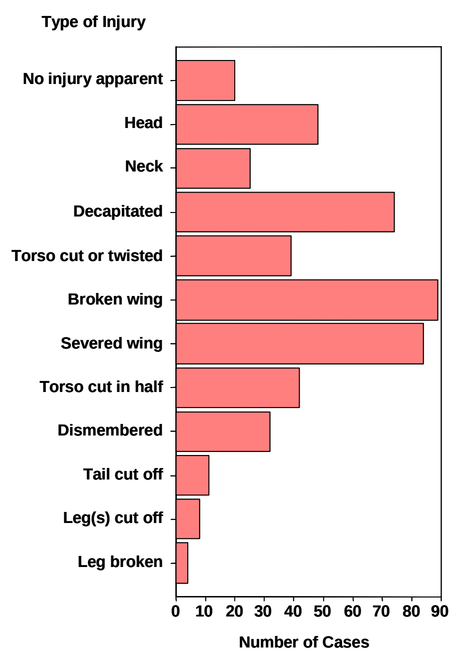


Figure 2-3. Frequency distribution of types of injury attributed to wind turbine-caused fatalities among birds found in the APWRA

CalWEA/KWEA-24: As discussed in the EPR (at p. 85), many (untested) mitigation strategies are being implemented by Buena Vista (a CalWEA member) in the course of its repowering project. These measures will be studied and may provide evidence of effectiveness that would justify widespread application of some measures. Ironically, Buena Vista, whose new permits incorporate many of the latest Smallwood/Thelander Report recommendations and whose future operation is widely viewed as an important test of these new measures, may have trouble maintaining its financing given the current climate of litigation (litigation that enlists the conclusions of the Smallwood/Thelander Report) and regulatory uncertainty.

Staff Response: Testing the effectiveness of mitigation measures applied to the Buena Vista repowering project will not serve as a reliable test of the same measure applied to old-generation wind turbines currently operating in the APWRA. The Buena Vista wind turbines will be mounted on much taller towers, and will operate differently from the existing wind turbines.

CalWEA and KWEA speculate that the Buena Vista repowering project may have trouble financing the project due to the current climate of litigation. Buena Vista has not made this claim to staff. In fact, the Buena Vista project was not legally challenged indicating that implementing the recommendations in Smallwood and Thelander 2004 may facilitate new developments.

CalWEA/KWEA-25: Finally, mitigation measures that are applied to the Altamont should not be assumed to be necessary or appropriate for other wind resource areas unless significant problems are documented and appropriate site-specific mitigation measures designed.

Staff Response: We agree with CalWEA and KWEA that mitigation measures applied to the Altamont should not necessarily be applied to other wind farms, and this conclusion can be found in Smallwood and Thelander (2004). We disagree, however, that any of these measures or variations of these measures should not be applied until after significant problems are detected at each wind farm. Appropriate mitigation measures should be decided upon prior to the installation of new wind turbines, wherever they happen to be, because doing so afterwards creates some of the very problems affecting the APWRA.

CalWEA/KWEA-26: There Is No Need To "Confirm" Low Mortality In Tehachapi, Pacheco and San Gorgonio. If Additional Studies Are Conducted, Appropriate Methods Must Be Used

The EPR states that:

> -- "studies completed in Tehachapi Pass, San Gorgonio Pass, and Pacheco Pass "report lower bird use and fatality rates" (at p. 6);
>
> -- "new information [from NREL] on the bird risk in the Tehachapi Pass is now available, and a comprehensive study of San Gorgonio Pass as well as a

companion document comparing the bird risk at both areas may soon be published" (at p. 84); and that

--"based on research results it may be appropriate for the Energy Commission *to encourage repowering and expansion* in these areas" (emphasis added) (at p. 16).

Yet the EPR also states (at p. 6) that "[s]tudies using *more current research protocols* could *confirm* that birds and bats are not as heavily impacted in these areas, which would allow for more wind development and lower rates of avian mortality than at Altamont Pass" (emphasis added).

A few points are in order. First, what constitutes "more current research protocols" is not defined. As evidenced by our discussion of the Smallwood/Thelander Report, "more current" does not necessarily mean "better." Before additional research is conducted, the methods currently being employed by Commission-funded consultants require peer- and public review. Second, as noted above, avian fatalities are not a constraint to development in areas outside of the Altamont. Third, the Commission ought not to expend resources when there is no evidence of a problem.

Likewise, without evidence of a problem, there is no need to study statewide impacts on bats, as recommended, or to "design mitigation measures to reduce bat collisions with turbine blades" (EPR at p. 16). Where there is a significant problem, bat carcasses are unlikely to be missed in routine carcass searches, so there is no need to study bats in particular. A 2004 Tehachapi assessment conducted for NREL found only one bat carcass. Although some bat mortality has been noted with the High Winds project in Solano County, there is no evidence that this mortality is biologically significant. A forthcoming San Gorgonio study by NREL should indicate whether bat mortality is an issue there.

On p. 16, the EPR states:

Past research shows that bird use for several raptor species is higher in the Solano County
Wind Resource Area than at the Altamont Pass. Recent post construction carcass surveys for the High Winds Project indicate a high rate of bird mortality. High bat fatalities are a newly identified issue in Solano County; the extent of which is uncertain. There is insufficient information on bird and bat fatality rates in the entire Solano County Wind Resource Area.

In fact, recent studies in Solano County show that American Kestrels and Red-tailed Hawks are more abundant than in the Altamont Wind Resource Area but not as high as stated in the Avian Assessment. American Kestrels and Red-tailed Hawks are two of the most common (abundant) raptor species and are neither endangered nor threatened under state or federal law. Additionally, contrary to statements made in the Avian Assessment, mortality rates for raptors in Solano County are significantly lower than in the Altamont, except for American Kestrels. Golden eagle mortality in particular is significantly lower in Solano County than in the Altamont.

Staff Response: CalWEA and KWEA argue that CEC resources should not be directed toward assessment of bird and bat fatality problems caused by wind farms outside the APWRA because there is no evidence of problems. However, the bird and bat mortality is much greater at the High Winds project compared to forecasts in the High Winds EIR. Within the first year of operation, golden eagle mortality was four times higher than expected, red-tailed hawk mortality was higher, American kestrel mortality was much higher than forecast, and bat mortality was also much higher. We expect that with increased rigor applied to post-construction monitoring at wind farms outside the APWRA, bird and bat mortalities will be greater than reported at San Gorgonio and Tehachapi, where small numbers of wind turbines were searched for fatalities at three-month intervals (Anderson et al. 2004, 2005). We will not know whether problems exist until adequate sampling is performed, and we believe monitoring is warranted after the experiences of the APWRA and High Winds. Staff is encouraged to see post construction monitoring at the High Winds site occurring every two weeks.

CalWEA/KWEA-27: The Suggestion That The Migratory Treaty Bird Act Should Be Used As a Tool to Reduce Fatalities Is Inappropriate.

The EPR states (at p. 6), “Most species of birds and raptors are protected under the Migratory Treaty Bird Act and the Bald Eagle Protection Act, but neither statute is being used effectively to reduce fatalities of hawks and eagles.” And (at p. 15), “most bird species being killed are protected under state and federal laws and are thus of concern to the public at large as well as environmental and wildlife law enforcement officials.” These statements imply that these federal statutes should be used as tools to reduce avian fatalities. As more appropriately stated by the USF&WS, “the Service attempts to work with those industries and individuals whose actions result in bird deaths, rather than pursuing criminal prosecution first.” This is especially relevant to wind-related avian fatalities, given the larger context described in section B.1, above.

Biological significance cannot be judged by lack of compliance, or indeed, compliance with, the Migratory Bird Treaty Act or even the Endangered Species Acts. Just as the taking of birds in full compliance with those Acts can be biologically significant to a species, so too can the incidental taking of birds protected by those Acts be less than biologically significant. Each analysis must be species and site specific.

While CALWEA agrees that reasonable and appropriate mitigation measures should be investigated and adopted, mitigation (and enforcement actions) should be proportional to the significance of the impact. As discussed above, the Avian Assessment provides no data on or discussion of whether the rates of fatalities are biologically significant to bird or bat populations.

Staff Response: CalWEA and KWEA argue that biological significance cannot always be concluded from violations of the MBTA. This argument is irrelevant because, as we understand the MBTA, there is no take provision under the MBTA, and any harm to special-status species requires the preparation of an EIR under CEQA, if we understand CEQA well enough. The premise is false that biological significance is needed as a precursor to mitigating wind turbine-caused bird or bat mortality.

CalWEA/KWEA-28: Avian Studies and Mitigation Are Being Appropriately Handled By Local Agencies

The EPR contains several statements suggesting that the local permitting process is inadequate to the task of avoiding "another Altamont." While it is true that the initial development at the Altamont occurred before either local agencies or the industry were sufficiently attuned to the avian fatality issue, times have changed.

We respond to particular EPR statements (all on p. 15) in this regard. The EPR states "to lower risks to birds, the developer should conduct protocol level bird use surveys prior to development." These studies are routinely required by local agencies in their role as the lead agency implementing CEQA. For example, Solano County is already requiring pre-construction and post-construction surveys as part of wind development projects to address siting and mitigation issues. The surveys have resulted in adjustments to project siting to take into account topographic features, and to avoid impacts to hunting and nesting activities. With respect to mitigation, the County has required offsite conservation easements, contributions to avian research efforts and the potential relocation of turbines that are shown to cause disproportionate mortality found during post construction monitoring.

The EPR states, "Expansion or repower projects should be required to incorporate mitigation measures and monitoring, and to report the results so fatality rates and mitigation efficacy can be assessed. Using that information, they can then site turbines to avoid areas of high avian use." Consider a motion adopted this month by the Alameda County Board of Supervisors containing conditions of approval for the Conditional Use Permits of the existing projects. The conditions include: formation of a scientific review committee; intensive county-managed monitoring to provide data for the EIR process; a repowering program that requires each company to repower 10% of its turbines by year 4 and 100% by year 13 (with interim steps in between); an EIR that will focus on repowering and other issues; shut down of the most dangerous 2% of turbines immediately; a 3.5- month winter shut down; an off-site mitigation program; and implementation of proven mitigation measures, all paid for by the industry and with no opt-out for financial hardship. The Board will vote on the final conditions at its September 22, 2005, meeting.

Contrary to the EPR's statement that "[s]tatewide guidelines for wind energy projects may be an appropriate way to gain consistency statewide when developing and mitigating projects," environmental assessment is highly site-specific. County-level control of the process is therefore appropriate.

Frankly, in view some of the recent work done by the Commission in this subject area as discussed above, the Commission has not garnered the wind industry's confidence in terms of its ability to conduct sound environmental science. We cannot support the notion of the CEC coming up with a second set of rules layered on top of existing state and local requirements. This is not to suggest that the wind industry necessarily agrees that all of these measures are well-founded.

Staff Response: These comments are addressed in earlier staff responses provided above. Staff looks forward to reviewing any results of scientifically rigorous monitoring programs aimed at understanding the effectiveness of any mitigation measure intended to reduce avian mortality. Staff stands behind the science used to develop the PIER report and subsequent staff assessments and argues that no other study used by industry to address avian impacts is based on the breadth of science used in the 2004 PIER report or was peer reviewed to the extent that this report has been.

Attachment A

Short CV of Dr. Smallwood

Kenneth Shawn Smallwood
Curriculum Vitae

109 Luz Place
Davis, CA 95616
Phone (530) 756-4598
puma@davis.com

Born May 3, 1963 in
Sacramento, California.
Married, father of two children.

Affiliations: BioResource Consultants

Disciplines: Wildlife, ecosystem and landscape ecology; conservation biology; sampling methods and systems analysis; agricultural ecology, animal damage management.

Education: Ph.D. Ecology, University of California, Davis. September 1990.
M.S. Ecology, University of California, Davis. June 1987.
B.S. Anthropology, University of California, Davis. June 1985.
Corcoran High School, Corcoran, California. June 1981.

Experience:

- 188 professional publications, including:
  - 49 peer reviewed publications
  - 22 in non-peer reviewed professional outlets
  - 108 reports and declarations
  - 8 in mass media outlets
  - 2 book reviews
- 66 public presentations of research results at professional meetings
- 67 papers reviewed by me for professional publications

Associate Editor, Journal of Wildlife Management, March 2004 to present.

Selected Publications:

Smallwood, K. S. and C. Thelander. 2004. Developing methods to reduce bird mortality in the Altamont Pass Wind Resource Area. Final Report to the California Energy Commission, Public Interest Energy Research – Environmental Area, Contract No. 500-01-019. Sacramento, California. 531 pp.

Smallwood, K. S. and C. Thelander. 2005. Bird mortality at the Altamont Pass Wind Resource Area, March 1998 – September 2001 Final Report. National Renewable Energy Laboratory, NREL/SR-500-36973. Golden, Colorado. 410 pp.

Smallwood, K. S., and L. Neher. 2004. Repowering the APWRA: Forecasting and minimizing avian mortality without significant loss of power generation. California Energy Commission, PIER Energy-Related Environmental Research. CEC-500-2005-005. 21 pp.

Smallwood, K.S. 2002. Habitat models based on numerical comparisons. Pages 83-95 *in* Predicting species occurrences: Issues of scale and accuracy, J. M. Scott, P. J. Heglund, M. Morrison, M. Raphael, J. Haufler, and B. Wall, editors. Island Press, Covello, California.

Smallwood, K.S. 2001. The allometry of density within the space used by populations of Mammalian Carnivores. Canadian Journal of Zoology 79:1634-1640.

Smallwood, K.S., J. Beyea and M. Morrison. 1999. Using the best scientific data for endangered species conservation. Environmental Management 24:421-435.

Smallwood, K.S. 1999. Scale domains of abundance among species of Mammalian Carnivora. Environmental Conservation 26:102-111.

Smallwood, K.S., B. Wilcox, R. Leidy, and K. Yarris. 1998. Indicators assessment for Habitat Conservation Plan of Yolo County, California, USA. Environmental Management 22: 947-958.

Smallwood, K.S., M.L. Morrison, and J. Beyea. 1998. Animal burrowing attributes affecting hazardous waste management. Environmental Management 22: 831-847.

Smallwood, K.S, and C.M. Schonewald. 1998. Study design and interpretation for mammalian carnivore density estimates. Oecologia 113:474-491.

Smallwood, K.S., B.J. Nakamoto, and S. Geng. 1996. Association analysis of raptors on an agricultural landscape. Pages 177-190 in D.M. Bird, D.E. Varland, and J.J. Negro, eds., Raptors in human landscapes. Academic Press, London.

Erichsen, A.L., K.S. Smallwood, A.M. Commandatore, D.M. Fry, and B. Wilson. 1996. White-tailed Kite movement and nesting patterns in an agricultural landscape. Pages 166-176 in D.M. Bird, D.E. Varland, and J.J. Negro, eds., Raptors in human landscapes. Academic Press, London.

Smallwood, K.S. 1995. Scaling Swainson's hawk population density for assessing habitat-use across an agricultural landscape. J. Raptor Research 29:172-178.

Smallwood, K.S. 1993. Understanding ecological pattern and process by association and order. Acta Oecologica 14(3):443-462.

Smallwood, K.S. and T.P. Salmon. 1992. A rating system for potential exotic vertebrate pests. Biological Conservation 62:149-159.

Professional Societies: The Wildlife Society
Society for Ecological Restoration
Association of Southwest Naturalists
Raptor Research Foundation
American Museum of Natural History

Honors and Awards:

Certificate of Appreciation, The Wildlife Society—Western Section, 2000, 2001
Fulbright Research Fellowship to Indonesia, 1987.
Northern California Athletic Association Most Valuable Cross Country Runner, 1984.
J.G. Boswell Full Academic Scholarship, 1981 (Paid expenses for undergraduate education).
American Legion Award, Corcoran High School, 1981, and John Muir Junior High, 1977.
CIF Section Champion, Cross Country in 1978 and Track & Field 2 mile run in 1981.
National Junior Record, 20 kilometer run, 1982.
National Age Group Record, 1500 meter run, 1978

Response to Sacramento Municipal Utility District Comments Received on the Assessment of Avian Mortality From Collisions and Electrocutions (Avian White Paper) August 30, 2005

WRITTEN COMMENTS

All comments are verbatim from the Sacramento Municipal Utility District comment letter

Responses provided by Commission staff and Dr. Smallwood lead author of *Developing Methods To Reduce Bird Mortality In The Altamont Pass Wind Resource Area.*

***SMUD-1*:** It is of particular concern to the Sacramento Municipal Utility District (SMUD or the District), because the proposed regulatory changes contained within CEC-700-2005-015 constitute significant ambiguous and paradoxical modifications to existing guidelines standardizing the current and future construction, siting, and monitoring actions or renewable wind power in California.

Staff Response: Staff did not propose regulatory changes in the Avian White Paper. Staff did propose statewide mitigation guidelines and standards which could help gain consistency statewide between new and repowering projects. Statewide guidelines could be developed based on research results, include stakeholders in the process, and could cover a variety of topics.

***SMUD-2*:** We disagree, however, with some of the conclusions drawn from this report with regard to avian mortalities within the Wind Resource Areas (WRAs) in California and with the conflicting way the conclusions were applied to both federal and state environmental laws and subsequent regulations. The following comments focus solely on Chapter 1 of the supplement, which is entitled “Avian Fatalities from Interactions with Wind Turbines.”

Staff Response: Staff reviewed the environmental regulations that affect wind energy development and was as comprehensive as possible about the state and federal laws that apply to these types of projects in California (page 7 of the Avian White Paper). Comment noted that all of SMUD’s comments relate to avian fatalities from wind turbines.

***SMUD-3*:** The supplement pairs admittedly obscure scientific facts with injudicious conclusions in regard to avian collisions with wind power turbines resulting in unlawful or non-permitted actions. Specifically, the document makes numerous references to avian fatalities resulting from wind turbines leading to legal action. The logic behind this premise is assumptive and based on one site-specific example in the Altamont Pass WRA. Logic dictates that litigation does not result in every case, and the document’s assertion creates an inflammatory and inaccurate perception of the litigious nature of wind power and renewable energy projects. In addition, throughout the document, assertions are made that documented avian mortalities and ongoing monitoring in wind resource areas could delay permitting processes for the expansion of existing WRAs or the development of new sites. Again, this statement is based on a site-specific example; it does not apply to the entire state and has no definitive bearing on the outcome of future permit processes.

Staff Response: We disagree that the supplement pairs obscure scientific facts with injudicious conclusions in regard to avian collisions with wind power turbines resulting in unlawful or non-permitted actions. All wind farms that have been monitored as part of a research program, or for post construction mitigation have reported incidences of bird collisions. There is a large body of reports and papers that document avian and bat collisions, some of which were sited in the Avian White Paper (see references pages 37-42), as well as other reports and studies nationwide that can be found elsewhere. Almost all the bird deaths result in a violation of existing federal and state laws. The National Wind Coordinating Committee has also identified avian fatalities as an issue affecting the permitting process.[1]

The paper points out that birds killed are a violation of existing laws and litigation is therefore possible. By acknowledging that, Energy Commission staff's intent is to take a proactive approach to lowering any potential for future litigation, prevent permitting delays, and promote the expansion of wind resources.

Staff concurs that litigation does not occur in every case, although there are several current examples of litigation occurring and of delays in permitting projects by the local agencies due to avian mortality issues. Here is an example of some:

- Pine Tree in the Tehachapi Wind Resource Area is currently being litigated
- Altamont Pass Alameda County permit renewals are being challenged in court
- Shilo I in the Solano County Wind Resource Area was required to redo the CEQA environmental documents and include information on bird mortalities from the High Winds project
- Buena Vista in Altamont Pass Contra Costa County was required to move from a mitigated negative declaration to an environmental impact report

SMUD-4: The supplement is assumptive and does not substantiate many of its statements. With respect to providing inadequate verification of its conclustions, the document states, in its summary of findings and policy options, that "Most bird species killed by interaction with wind turbines…are protected by Federal and State laws and regulations." However, the document also asserts that evidence for high avian mortality resulting from contact with wind turbines is "insufficient,…cannot be accurately quantified, … and is not clearly understood." These two separate statements in the document are dichotomous and inconclusive relative to a valid assessment of avian mortality associated with wind energy turbines. In addition, with the extensive ongoing efforts to monitor avian fatalities in California, deriving that conclusion is premature at this point in time. Proper evaluation of studies available to both the public and the CEC indicate that the mortality or injury of bird species protected under federal and state laws, as a result of contact with wind turbine infrastructure throughout California, vary extensively from site to site, depending on the behavioral pattern of the species and the habitat. This site-specific evaluation is not correctly identified in the document when comparing the fatality ratio to the number of listed and protected species. The document's assessment fiver the contextual impression that these types of fatalities are continuous statewide in all WRAs;

[1] Anderson, R., et al. 1999. Studying Wind Energy/Bird Interactions: A Guidance Document. Prepared for the Avian Subcommittee and the National Wind Coordinating Committee.

however, the reported lack of concrete and protracted research on avian monitoring within other WRAs is inconclusive with respect to the valuation of protected species and cannot support an estimation of total fatalities, at present.

Staff Response: The quoted phrases that SMUD uses can be found in the Avian White Paper in several different contexts.

The full quote for "…insufficient" is: "There is insufficient information on bird and bat fatality rates in the entire Solano County Wind Resource Area". As further explanation and context, staff determined that there is limited information available in public documents and reports to determine current fatality levels Solano County wide. Preliminary fatality information is available for the High Winds project.

The full quote for "…cannot be accurately quantified" is: "Several studies have tried to estimate the number of bird deaths from interactions with utility structures; however, without further research, they cannot be accurately quantified." As further explanation and context, this refers to the number of avian deaths from collisions and electrocutions with power lines and poles. This is not part of Chapter 1, and does not refer to interactions with wind turbines. In fact, the methodology exists to quantify fatality rates from interactions with wind turbines and has been used in numerous studies.

There are two places in the Avian White Paper that use "…and is clearly not understood". The first is: "The resulting effect of lights on avian and bat fatalities is not clearly understood". This refers to the increasing FAA requirements to use lights on the taller turbines, and how lights may impact bird and bat fatality rates. Light impacts from wind turbines have not been researched. The second is "Bird deaths result in impacts to the species, although the extent of the impact is not clearly understood." The second statement acknowledges that although bird fatalities occur, the extent of impact (deaths) on the regional or larger population is not clearly understood.

None of the above statements or conclusions changes the fact that most bird species killed by interactions with wind turbines are protected by state and/or federal laws and regulations.

In California, studies show that fatalities are occurring in all wind farms, but staff concurs that mortality varies from site to site. Bird collision is related to bird risk as defined by bird use. Therefore, areas with low bird use are expected to have low collision rates, and areas with high bird use have high bird collisions. A WRA specific summary of the known information was conducted as part of the Avian White Paper (pages 17-23) to highlight the differences in information known of baseline bird use, fatality rates, and development of suitable mitigation measures between WRAs. Ongoing survey results from such sites as SMUD's phase 1 and 2 wind development as well the High Winds, which both utilize new turbines in Solano County will provide much needed information on fatality rates in Solano County. Staff also recommends that the Energy Commission continue their support for research that reduces avian fatalities while allowing for the expansion of wind resources.

SMUD-5: The supplement incorrectly identifies guidance documents as the proper tool for use and implementation by the industry associated with the siting and surveying of a wind power turbine in an effort to avoid potential avian collisions. Specifically, the document cites guidance issued by the U.S. Fish and Wildlife Service, referenced as "The ABC's of Avoiding Bird Collisions at Communications Towers" (Manville, A.W., 2000), recommending that the industry follow a monitoring pattern suggested for suitable avian avoidance of wind power turbines. Guidance issued by the USFWS or any federal or state agency has a non-binding legal effect; it is more specifically designed to address unprecedented legal matters. Given the non-binding nature of guidance in any form, the suggestion offered in this document, that guidance form a basis for implementation, is inappropriate and should not be recommended in place of binding statues…In addition, the guidance issued by the USFWS…is specific to communications towers and their siting; it is not explicit to wind turbines, and is therefore inappropriate in the context of this document… In addition the document references the protections offered under the Migratory Bird Treaty Act…on behalf of those bird fatalities occurring with the WRAs. Specifically, the document states, "Under the Migratory Bird Treaty Act (MBTA), the U.S. Fish and Wildlife Service (USFWS) can take legal action if measures are not being implemented to reduce the impacts to all migratory birds,…therefore, it (USFWS) established a protocol to conduct a site evaluation and wildlife use surveys….Given the reasons already states, this statement is inappropriate because the statutory regulations governing activities under the MBTA differ from the non-binding nature of guidance documents.

Staff Response: It is unclear why SMUD states that guidance documents are not the proper tool for siting wind farms. In fact two documents by the NWCC[2] are widely accepted nationwide for properly siting wind farms. Staff did not site "the ABC's of Avoiding Bird Collisions at Communications Towers" (Manville 2000) as part of this discussion. The context for which staff did site Manville 1999 was in Chapter 2 of the paper that discussed electrocutions and collisions from power lines. The citation on page 28 states "Fatal impacts from collision with power lines and utility structures have been documented for nearly 350 species (Manville 1999)". Utility structures refer to power line poles. Staff does not the "ABC's of Avoiding Bird Collisions at Communications Towers" as part of their discussion on wind energy siting and survey guidance documents on page 8. In that same section staff states "The U.S. Fish and Wildlife Service recommends…". Staff concurs that the guidance documents are non-binding and voluntary. The U.S. Fish and Wildlife Service has issued guidance explicit to wind turbines which were sited in the text (U.S. Fish and Wildlife Service 2003). [3]

SMUD-6: The supplement incorrectly draws the conclusion that avian mortality associated with wind energy turbines could be reduced by enhancing and increasing mitigation. All new project in the state of California qualifying as a project under the California Environmental Quality Act…are statutorily required to perform mitigation for physical conditions that exist within the area affected by a proposed project. Therefore, all new projects, whether the expansion of an existing WRA or the development of a new one, will be subject to mitigation under CEQA. This statue also applies to existing wind resource projects that have been undergoing mitigation monitoring and reporting since permit

[2] National Wind Coordinating Committee guidance documents authored by Anderson 1999 and Therkelsen and Grant 1998.

[3] U.S. Fish and Wildlife Service. 2003. Service Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines. U.S. Department of Interior. Washington D.C. Pp. 57.

issuance. Due to the statutory nature of mitigation under the CEQA, industry members, in consultation with Federal, State, and local agencies have worked collaboratively to come to agreements on area-specific mitigation monitoring plans. The document fails to mention existing mitigation measures that wind turbine power owners and operators have been required to implement. With the exception of the Altamont Pass WRA, the document does not take into account existing mitigation measures, monitoring, and reporting currently underway throughout California's WRAs. To properly evaluate the extent that enhanced mitigation could aid in decreasing avian mortality associated with wind energy turbines, a thorough evaluation of these existing measures ought to have been conducted.

Staff Response: SMUD states that the Avian White Paper "incorrectly" draws the conclusion that avian mortality could be reduced by enhance or increased mitigation. SMUD instead asserts that wind projects are already subject to CEQA and thus permits for both existing and new wind facilities identify mitigation requirements. There are mitigation measures available that would lower avian collision rates such as removal of high risk turbines, or seasonal shut down. These two measures are the most restrictive, but would undoubtedly reduce collision rates due to the reduction of spinning turbine blades. There are other measures that have been used for mitigation in multiple CEQA documents such as tubular towers instead of lattice towers to reduce perching, but based on current research, perching rates did not affect collision rates.

Staff conducted a review of the research completed as well as discussed the new projects being permitted and how avian impacts have been addressed in the process. Out of the review came the conclusion that the process can be different in each of the local jurisdictions including preconstruction and post construction monitoring. Staff evaluated the effectiveness of existing mitigation measures and assessed whether additional or different measures might be equally or more effective in preventing avian mortality in wind energy facilities. In at least two places staff concluded that adoption of turbine siting and land use mitigation measures should be monitored to determine the effectiveness of the mitigation (pages 19 and 22). Staff also reviewed recent projects as part of the discussion of wind resource areas and discussed what types of mitigation were being implemented (pages 17-23).

To the extent that SMUD is suggesting that there are no feasible means for reducing avian mortality other than those already imposed as permit conditions, staff disagrees and believes that additional research may yield important information about mitigation that could reduce mortality. The recommendations in the report are focused on supporting additional data collection and research to improve our understanding of the best ways to minimize avian mortality from wind energy and other types of electrical infrastructure facilities.

SMUD-7: The document improperly places mitigation monitoring authority under the auspices of the California Energy Commission (CEC). Under CEQA guidelines…the responsibility of mitigation monitoring measures are held by the Lead Agency applicable when findings have been made and required under paragraph (1)…The Lead Agency is additionally charged with the primary responsibility of protecting the species affected by wind energy turbine projects, according to further CEQA guidelines…For these reasons, the District believes that mitigation measures and the evaluation thereof ought to be assessed by the lead and responsible agencies whose mission it is to steward those species affected to determine the measures' effectiveness in protecting sensitive groups. The District considers the recommendation the CEC in this supplement to enhance existing mitigation measures inappropriate given the Commission's mission and that any recommendation to do so must be based on sound scientific evidence coupled with specialized appropriate agency experience; not conjecture largely based on assumptions.

Staff Response: The report in no way implies that the Energy Commission should assume the responsibilities of permitting agencies in ensuring that mitigation measures are properly implemented as part of the CEQA process. Rather, the report includes policies and recommendations that the Energy Commission may wish to include in the 2005 IEPR. These policies and recommendations would be input to be considered by Lead and Responsible agencies in making permitting decisions for wind energy facilities. The Energy Commission is a responsible agency for energy related projects
And staff believes it has an affirmative obligation to offer recommendations and guidance consistent with its expertise to other agencies. Staff believes the local permitting process can be supported and made more consistent with the adoption of statewide guidelines.

SMUD-8: …the District respectfully agrees with the Commission that there is a strong and pressing need to minimize the impact that wind energy turbines have on avian species. We support the continuing efforts by the CEC to sponsor scientific studies that will augment existing efforts to increase our understanding of avian interactions with wind energy turbines. We recommend that these studies be conducted with continuing industry input and performed in a systematic way aimed to close existing data gaps.

Staff Response: Staff appreciates SMUD's support of continuing research efforts to lower avian interactions with wind turbines. Since SMUD owns wind turbines at the Solano County Wind Resource Area staff looks forward to collaborating on studies and exchanging information that can accurately quantify avian impacts and work on developing and adopting mitigation measures for that location.

Response to PPM Energy Comments Received on the Assessment of Avian Mortality From Collisions and Electrocutions (Avian White Paper)
August 30, 2005

WRITTEN COMMENTS

All comments are verbatim from the PPM Energy comment letter

Responses provided by Commission staff and Dr. Smallwood lead author of *Developing Methods To Reduce Bird Mortality In The Altamont Pass Wind Resource Area.*

PPM-1: The CEC report (page 4) states that “recent post-construction carcass surveys for the High Winds Project indicate a high rate of bird mortality.” That and similar statements elsewhere in the report suggest that the Solano Wind County Wind Resource Area may be an area of high risk to birds and bats. However, that conclusion is not substantiated by the estimates of avian mortality quoted in the same CEC report. Mortality estimates on page 22 of the report indicate that High Winds avian mortality rate is 0.924 birds/MW/year (uncorrected for searcher efficiency and scavenging). According to our own calculations, this estimate seems high, but in this comparison, I will use them for purposes of argument. Figure 3 of the same report shows that unadjusted “all bird mortality” is lower at Solano than at Tehachapi or Altamont, even though searches were conducted more frequently at Solano than the other two areas. The “all bird mortality rate” at Solano of just under 1 bird/MW/year compares favorably with data from other regions of the state and the rest of the country, as shown below in Table 1. The Solano estimates have not been corrected for scavenging or searcher efficiency (scavenging and searcher efficiency trials are planned to be completed in the next monitoring year).

Staff Response: Research has consisted of; background bird use, research on fatality rates for avian species and bat species, and using the background information to develop siting criteria and mitigation measures that lower avian and bat fatalities. In Solano County the largest report on background bird use is reported in Orloff and Flannery 1992. They focused their surveys on raptors and observed that Solano County relative abundance for American kestrels, red-tailed hawks was higher than at Altamont; Golden eagles and turkey vultures were lower.

At the workshop on June 28, staff announced that several of the numbers had been switched and the recalculated unadjusted mortality rate for all birds at the High Winds site was 0.65/MW/year. This correction also appears as an errata to the Avian White Paper. In the Table 1 provided in your letter, you are comparing estimates of unadjusted avian and raptor mortality at Solano County and the Altamont Pass with regional adjusted rates. In the table the unadjusted rates for raptor fatalities in Solano County are already higher than any of the adjusted rates in any of the regions that you present the data for, although the unadjusted rates for all birds are lower than for the other wind areas. Unadjusted rates should not be compared to adjusted rates, as the adjustment increases the fatality rates. In the Avian White Paper staff acknowledges that so far the Altamont Pass still has the highest adjusted fatality rates. More information is needed in Solano County, including results for the trials that you comment will be going on next year.

PPM-2: For some reason, the CEC report, rather than focusing on overall avian mortality, appears to be more concerned with raptor mortality at the Solano Wind Resource Area. It is true that of the avian mortality at the High Winds project, a higher proportion is raptors than at other projects. However, most of the raptors that have been killed at the High Winds have been American kestrels and red-tailed hawks – two of the most common raptors in the country, which are not protected by the ESA (although the are, like most birds protected by the MBTA). The High Winds monitoring report suggests that the high proportion of raptors in the observed avian mortality may relate to a cyclical upswing in the local population of mice and voles. Results from the next two years of monitoring will help determine whether that is in fact the case.

Staff Response: As staff reported in the Avian White Paper many of the previous studies focused on raptors and not all bird species. Orloff and Flannery (1992) reported that raptor use for several species was higher in Solano County than at the Altamont Pass. The bird use information for Tehachapi Pass includes birds and raptors. The information for San Gorgonio is not available yet. Almost all of the species killed by interacting with wind turbines are protected by the Migratory Bird Treaty Act, with additional protections under state code. Raptor species also have additional protections. Many red-tailed hawks and American kestrels are killed at other wind resource areas too. There is more information available for raptors as a group, then all birds, which is why staff is encouraged to see new surveys include all species. Staff believes that measures should be taken to reduce collisions for all species to the greatest degree possible.

Energy Commission staff supports three years of post construction monitoring, and as results become available from your post construction surveys they will be invaluable to updating the conclusions outlined in the current Avian White Paper. Another important aspect of the surveys is searcher bias and scavenger rates and completing these trials along with your other survey mitigation requirements will expand our current knowledge of fatality rates in Solano County.

PPM-3: The High Winds avian mortality monitoring will be continuing for 2 more years, and the monitoring at the adjacent Shiloh 1 Wind Project will continue for 3 years after construction, allowing a full evaluation of the level and nature of bird and bat mortality in this wind resource area. However, the data available to date and quoted in the CEC report do not support the CEC's conclusion that the Solano Wind Resource Area has high avian mortality; in fact they demonstrate the opposite.

Staff Response: Staff is encouraged that the current levels of post construction monitoring is occurring at both of these wind farms for 3 years. Using the post construction monitoring to determine the level of impacts is the first step. This information can be used to develop additional research that develops mitigation measures or siting criteria that can lower avian and bat impacts for in Solano County. The Energy Commission staff looks forward to collaborating on further research questions that resolve avian impacts. See staff comment responses to PPM-1 and PPM-2 for further discussion of mortality rates.

Staff Response to CalWEA August 9, 2005 Letter, Attachment 1: "Significant Calculation Errors Found in the August 2004 PIER Report", Carol Pilz Weisskopf, PhD.

CW-1: Golden Eagle Mortality Factor

"The mortality factor for golden eagles used in the PIER report appears to be in error by a factor of 3. The reported factor is incorrect because it is not derived following the procedure explicitly stated by the authors as the calculation they performed. …Thirty-one golden eagle carcasses were found during Set 2 searches – of these, 10 were given an estimated time since death (ETD) prior to carcass discovery of less than 90 days, 6 were given ETDs of 90 days or more, and 15 did not have ETDs. …When all 15 carcasses with unassigned death dates are added to the 10 'fresh' carcasses, the calculated factor matches the Set 2 mortality factor (within 1%) – the old remains, bones pieces and talon described in Table 1 [a table of the 15 alleged old remains included in the mortality estimation] were apparently used in calculation of the factor (there is no other explanation)."

RESPONSE: There is another, simple explanation. Weisskopf transposed the data, thereby incorrectly changing the mortality factor for golden eagles by a factor of 3. Weisskopf switched the number of golden eagle carcasses given an Estimated Time since Death of greater than 90 days (15 in Smallwood and Thelander, 6 by Weisskopf's analysis) with the number categorized as not having ETDs (6 in Smallwood and Thelander, 15 in Weisskopf analysis). Her Table 1 lists biologists' notes of 15 carcasses that she said were used by Smallwood and Thelander to estimate golden eagle mortality, but in fact they were not used because Smallwood and Thelander considered them too old. It was only a coincidence that Weisskopf's calculation using the wrong group of golden eagle carcasses nearly equaled the unadjusted estimate of Smallwood and Thelander (2004); however we cannot determine from her comment how she did this.

We will describe how Smallwood and Thelander estimated golden eagle mortality so that the reader can track the procedure. The number of turbine-killed golden eagles found at each Set-2 turbine string was divided by the rated MW output of the turbine string and by the time span in years over which fatality searches were performed. Mortality calculated at each string was averaged among the 280 strings composing Set 2, arriving at the unadjusted average mortality, 0.13909 fatalities/MW/year. This value was multiplied by 1.08 to adjust for the search radius shortfall to arrive at 0.15022/MW/year. This value was divided by 0.85 to adjust it for searcher detection rate, yielding 0.17672/MW/year, which Smallwood and Thelander regarded as the lower bound of the mortality estimate. The upper bound of the mortality estimate was calculated by dividing this lower mortality estimate by the scavenger removal term taken and adjusted from Erickson et al. (2003), which was a WEST, Inc. study done for the Stateline, Oregon wind development . Erickson et al. (2003) estimated that after 40 days, 58.6% of carcasses of large-bodied species were removed on average. Smallwood and

Thelander added 10% to this estimate because their search intervals were longer, thus yielding an estimate of 68.6% carcass removal between search intervals. This estimated scavenger removal rate, expressed as a proportion, leaves 0.314 to be divided into the mortality estimate that was adjusted by search detection – 0.314 is the fraction of carcasses Smallwood and Thelander would have found had scavengers not removed the others, according to Erickson et al. (2003). However, as stated in their report, Smallwood and Thelander did not believe this estimated term was appropriate in the APWRA, and based on their experience there, they doubled the proportion of carcasses they believed they would have found had the carcasses not been scavenged. They divided 0.17672/MW/year by 0.628 to arrive at an adjusted mortality rate of 0.28141. (Using Erickson's value of 0.314 would have resulted in a higher adjusted mortality rate of 0.56280/MW/year.)

It is important to note that by doubling of the proportion of carcasses that would have been found after scavenger removals, Smallwood and Thelander introduced a conservative factor into the upper bound of the mortality estimate. Had Smallwood and Thelander relied entirely on Erickson et al. (2003), then the mortality estimate of golden eagle in the APWRA would have ranged 75.6 to 220.7 (rather than the estimate of 75.6 to 116.5).

It is also important to note a report on avian monitoring and risk assessment at the Tehachapi Pass wind resource area (Anderson et al. [including Erickson] 2004) that was released after Smallwood and Thelander (2004) included a scavenger removal rate that is much higher than reported for the Stateline Study (Erickson et al. 2003). In the Tehachapi WRA, which is much closer to the Altamont Pass WRA than is the Stateline Project, scavengers removed 96% of hand-placed bird carcasses in only 8 days (Anderson et al. 2004). Had Smallwood and Thelander relied on the Anderson et al. (2004) estimates, then their mortality estimates would have been higher yet. However, Smallwood and Thelander remain comfortable with the adjustments they made, but would welcome appropriately obtained APWRA-specific estimates.

CW-2: Red-tailed Hawk Mortality Factor
"Set 2 included 56 red-tailed hawks, 25 of which were assigned ETDs less than 90 days, 16 assigned 90 days or longer, and 15 with no ETDs. As with the golden eagles, the 25 'fresh' and 15 unassigned red-tailed hawks were apparently used to calculate the Set 2 mortality factor (our calculated factor matches the report's within 2%), again a significant error in calculation..."

RESPONSE: Similar to the golden eagle comment, Weisskopf presents incorrect numbers of red-tailed hawks assigned to categories of estimated days since death. The number, 25, is correct for the category of carcasses <90 days since death, but the unassigned number is 4 and the >90-days number is 27. We do not know how she came up with 15 and 16 in the unassigned and >90 day categories – perhaps they were based on incorrect assumptions. The rest of her calculations are therefore wrong because they are based on the incorrect assignment of red-tailed carcasses to categories of ETD. We do not know how she ended up with her "corrected" estimate.

CW-3: Great Horned Owl Mortality Factor

"Although these examples illustrate poor quality assurance in the data and calculations, as well as a significant lack of investigator oversight and critical review, it would be merely a procedural (although serious) error if it were applied evenly throughout the data set. However, 5 great horned owls were also found in the Set 2 searches – none was assigned a death date. Contrary to the inclusion of all unassigned hawks and eagles, *only one* set 2 great horned owl carcass was selected from which a mortality factor was developed. Since only one, and not all, of the old owl carcasses was used, unassigned carcasses are apparently included in the calculations *not* as a procedural error but by conscious decision."

RESPONSE: It is true that only one of the Set 2 great horned owl fatalities was used in the mortality estimate. It was in fact a conscious decision based on procedure. Smallwood and Thelander examined the comments on the fatality forms, including the photo of the remains, and decided to include the carcass in the category of ETDs <90 days. It seems that Weisskopf is arguing to use the 5 fatalities with unassigned ETD's in this comment, while arguing that Smallwood and Thelander should not have used these fatalities in the above comments.

We cannot determine how Weisskopf arrived at her estimates in Table 3. She refers to them as "corrected," but does not explain how they were corrected.

We point out, also, that the Smallwood and Thelander mortality estimate for great horned owl is higher in the final report to the National Renewable Energy Lab (2005), which also was peer-reviewed by independent scientists. This mortality estimate did not include fatality searches at Set 2 turbines, but extrapolated the mortality estimate from Set 1 turbines across all turbines in the APWRA. Smallwood and Thelander (2005) estimated 19 to 38 great horned owls are killed annually by wind turbines in the APWRA. This example goes to show the degree to which including fatality searches among Set 2 turbines in the CEC report reduced the effect of extrapolations of mortality estimates derived from a relatively small set of wind turbines occurring in one portion of the APWRA. Extrapolating from Set 1 turbines increased mortality estimates for some species, but decreased them for others, because species varied in their fatality rates at different portions of the APWRA.

Staff Response to CalWEA August 9, 2005 Letter, Attachment 3: Example of Correction Factors Used in August 2004 PIER Report: How a Single Cowbird Carcass and Feathers Turned Into 435 Fatalities. Comments in black, responses in red.

We document here how wind-avian fatality estimates in the August 2004 Smallwood-Thelander Report rely on an excessive number of overly large correction factors. These correction factors were employed because of the short study duration and the limited number of searches as well as the long interval between the two searches conducted in the study.

RESPONSE: We disagree the number of correction factors was excessive. Three were used, which were for rates at which (1) carcasses were undiscovered outside the 50-m search radius, (2) searchers missed carcasses within the 50-m search radius, and (3) scavengers removed carcasses. These are correction factors normally made by investigators of turbine-caused bird fatalities - see attached guidance documents by the National Wind Coordinating Committee (NWCC), Avian Power Line Committee (APLIC) and the 1994 National Avian-Wind Power Planning Meeting Proceedings. None of the correction factors had anything to do with the number of searches conducted.

The 2004 Report provides mortality estimates without the correction values, with one correction value, and with all correction values. This allows the reader to fully understand the information presented.

On October 30, 2002, feathers from a brown-headed cowbird were found by a pond 131 meters (430 feet) down the hill from the closest turbine tower (299) in the Patterson Pass wind park. Notwithstanding its location and distance from the turbine, it was assumed to be a wind power fatality rather than, for example, a hawk's lunch. It was assigned BRC number 1270.

RESPONSE: The mortality estimates for bird species, including the brown-headed cowbird, were made only for bird species with more than one turbine-caused fatality. (see Methods section in Smallwood and Thelander 2004). Regarding the fact that some birds were found at a distance from turbines, Smallwood submitted to the National Renewable Energy Lab his eye-witness report of a rock dove struck by a wind turbine and thrown 50 m. The bird was still alive and flew away from the wind turbine another 150 to 200 m before it fell to the ground, where it was later found dead. Winkelman (1992) reported that 17 percent of collision victims were wounded but still alive. These are usually accounted for by another bias, crippling bias, which was not applied in the Smallwood and Thelander study, but would have resulted in higher mortality estimates. Feather spots are completely acceptable and standard evidence used for estimating the collision mortality (see attachments).

Weisskopf uses an outlier in her example. The vast majority of birds used in Smallwood and Thelander's analysis were found within 50-meters of the towers. For large-bodied birds, 84.7% of the carcasses found were within 50 meters. For small-bodied birds, 90.5% of all carcasses found were within 50 meters of the turbines (see Figure 2-9).

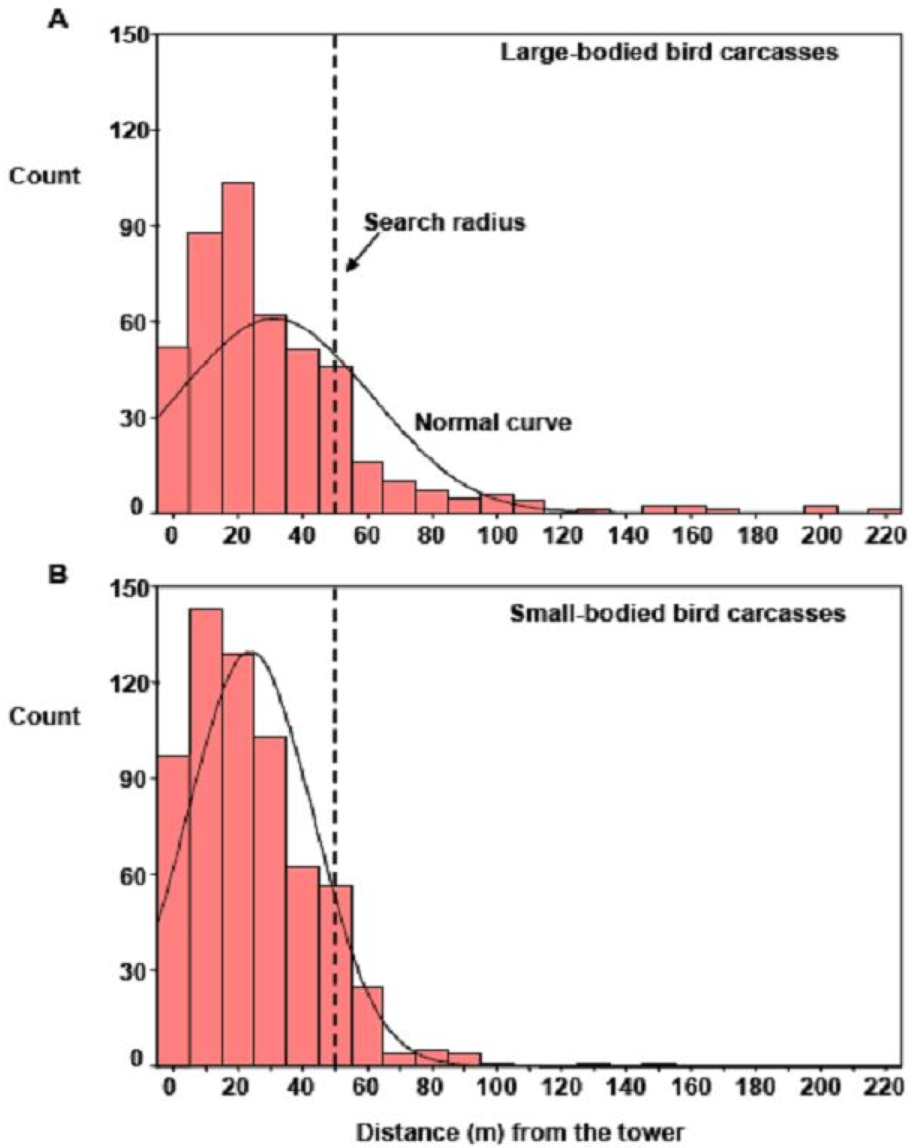


Figure 2-9. Frequency distributions of distance from the wind tower among carcasses of large-bodied (A) and small-bodied (B) birds species.

It is standard protocol to use feather spots when estimating mortality caused by collision (see attachments describing standard protocols). Erickson et al. 2003 (Nine Canyon Wind Power Project Avian and Bat Monitoring Report) reported 42% of their fatalities were feather spots. Anderson et al 2004 (Avian Monitoring and Risk Assessment at the Tehachapi Pass Wind Resource Area) reported 55.1% of fatalities were feather spots. In Smallwood and Thelander, feather spots accounted for 22% of fatalities.

The probability that the cowbird death was caused by another hawk, as suggested by Weisskopf, is likely much lower than the probability that it was hit by a moving turbine blade. The species of raptors in the Altamont that are likely to capture a cowbird, e.g. Cooper's hawk, sharp-shinned hawk or prairie falcon, are extremely rare in the Altamont. Turbines are not rare.

Other studies have shown natural mortality in wind farms are rare. During a wind-avian study Buffalo Ridge in Minnesota, Johnson et al (2000) conducted searches in reference plots and concluded that there was too little natural mortality to continue with that effort and decided to attribute all mortality to wind turbines. In addition, the lead author of the San Gorgonio study stated in a personal communication that there was too little mortality not caused by turbine blades in wind farms to justify the time and cost of the effort and that nearly all fatalities were turbine-caused (Richard Anderson, personal communication July 2005). In their report of bird collisions with wind turbines in the Stateline project, WEST did not make any effort to estimate background mortality.

The Turbine String

Tower 299 is part of a 2-turbine string. Although the turbines are 65 kW machines, they were incorrectly identified as 150 kW turbines in the report; for consistency we will use 150 kW in this exercise. The turbines were searched twice (October 31, 2002 and February 11, 2003) as part of the second study set in the CEC report.

RESPONSE: It is not true that only one turbine string included a brown-headed cowbird, and it is not true that Smallwood and Thelander (2004) mistakenly identified a 65-kW turbine model as a150-kW turbine model. According to Joan Stewart of Greenridge Services (correspondence with Smallwood and Thelander on 5 June 2003), none of the Bonus turbines are 65-kW turbines. However, we point out that if the Bonus 150 turbines are truly 65-kW turbines, then the resulting mortality estimates of Smallwood and Thelander (2004) were too low because the denominator (MW) in the mortality calculation would have been smaller.

The Study Duration

In the data for this study, discovery dates in all cases reviewed precede the search dates by one day; the reason is not known, but this does not change the calculation.

RESPONSE: It is not true that the discovery dates preceded the search dates by one day. We checked the data sets to confirm, and Weisskopf was incorrect.

Carcasses judged less than 90 days old were used for the calculation, so 90 days were added to the duration of the study (the 103 days between the search dates) to adjust for the period before the first search.

Study duration (years): 0.529

Cowbird Mortality for Set 2 Turbines:

Carcass count/string MW/study duration = deaths/ MW/year for that string
Deaths /MW/year (string)/total number of strings = deaths/MW/year for the set. No weight was given to short strings (1 turbine) or long strings (62 turbines).

1/0.3/0.529 = **6.30 d/MW/y for the string;**
6.30/280 = **0.0225 d/MW/y for Set 2 from this calculation**
Reported set 2 d/MW/y: 0.0227

RESPONSE: The difference between mortality calculations is due to the difference in the study duration, but the difference is small.

Calculating Cowbird Mortality for Turbines not Searched (Set 3)
The MW-weighted average for Sets 1 and 2 turbine mortalities was applied to Set 3 turbines.

Reported set 1 d/MW/y: 0.0033

Cowbird Mortality for Set 3 Turbines:
(d/MW/y set 1 x MW set 1 + d/MW/y set 2 x MW set 2)/(MW set 1 + MW set 2)

(0.0033 x 151.165 + 0.0227 x 267.09)/(151.165 + 267.09) = 0.0157 d/MW/y

Unadjusted Total Altamont Mortality
d/MW/y set 1 x MW set 1 + d/MW/y set 2 x MW set 2 + d/MW/y set 3 x MW set 3

0.0033 x 151.165 + 0.0227 x 267.09 + 0.0157 x 161.750 = 9.10 deaths/year

Adjustments
It was assumed that searchers did not find all of the carcasses in the study plots. It was assumed that if one carcass was found, there must have been more of them to start with.

RESPONSE: This assumption was based on the fact that previous searcher detection and scavenger removal trials repeatedly confirmed that searchers do not find all the birds actually killed by the wind turbines. Smallwood and Thelander (2004) relied on Orloff and Flannery (1992) and Erickson et al. (2003) for estimates of rates to correct for birds not found due to searcher detection error and removal of carcasses by scavengers. These are standard adjustments applied to wind turbine-caused mortality estimates. As we have pointed out elsewhere in our responses to comments, had Smallwood and Thelander used the Erickson et al. (2004) estimate of scavenger removal rates of carcasses in the Tehachapi wind resource area, their resulting mortality estimates would have been considerably higher.

Searcher Efficiency
From Erickson et al. (2003) and Johnson et al. (2002) a 41% searcher detection of small bird carcasses was used. When any carcasses were found beyond the 50 m search radius, a species-specific factor was added. This served to inflate, rather than diminish, the importance of distant carcasses.

RESPONSE: We disagree that this adjustment inflated the mortality estimate and do not understand the technical basis of Weisskopf's conclusion the adjustment inflated rather than diminished the importance of carcasses found beyond 50 m. As is common practice in ecological investigations, Smallwood and Thelander (2004) used their professional judgment to establish a decision-rule for adjusting the mortality estimates according to the proportion of turbine-caused bird fatalities found beyond 50 m. Smallwood and Thelander (2004) established that birds struck by wind turbines often hit the ground beyond their 50-m search radius. Injured birds moved beyond the 50-m search radius and died there. Scavengers carried carcasses to locations beyond 50 m, and some of these dragged carcasses were detected by feather trails, leading from where the bird hit the ground to where the search crews either found the bird or lost the trail. The decision rule for adjusting mortality estimates by the shortfall in the search radius was then applied to each species included in Smallwood and Thelander's data set (at least two turbine-caused fatalities discovered during the sampling program). The assumption that the carcasses found beyond 50 m were only half the number that actually ended up there was made after examining the rates other investigators applied to search detection and scavenger removal. Smallwood and Thelander could have assumed the proportion outside the 50-m search radius was larger, based on the adjustment terms used by others and based on evidence in the field, but they decided not to because they wanted to err on the conservative side.

The NWCC guidance document referred to in Rader's cover letter states "*It is neither possible nor appropriate to provide a detailed 'cookbook' approach to every site-specific situation*". Furthermore, "*…many situations will require site-specific knowledge and expert recommendations as to which study design and methods are most appropriate.*"

Since one cowbird was found < 50 meters from a turbine (in the first set), and one was found >50 meters from a turbine (the Set 2 feathers), an additional 50% of cowbirds in each set was assumed missed, so a detection rate of 20.5% was used for cowbirds.

Set 1 & 2 searcher efficiency multiplier: 4.88

Scavenging Rates
From Erickson et al. (2003), the scavenging rate of small bird carcasses at the Stateline wind project in Oregon and Washington (80.2% carcass removal in 40 days) was applied to the Altamont for Set 1. The average Set 1 search interval was 53 days. Because the Set 2 search interval was longer (90+ days) 90.2% of carcasses that might have been there were assumed to have been removed. 100/scavenging rate = scavenging rate multiplier

Set 1 scavenging multiplier: 5.05
Set 2 scavenging multiplier: 10.2

Searcher Efficiency-Adjusted Total Altamont Mortality
d/y x search efficiency factor (since the factor was uniform across sets)

9.1 0 x 4.88 = 44.4 cowbird deaths/year from this calculation
44.3 reported

Scavenger and Searcher Efficiency-Adjusted Altamont Mortality
In this case, the scavenging factor was unequal across sets (5.05 vs. 10.2), so the Set 1 and Set 2 d/MW/y are multiplied by their factor, a MW-weighted set 3 factor recalculated, and the Altamont scavenger-adjusted total multiplied by 4.88 for searcher efficiency.

434.9 cowbird deaths per year from this calculation
434.9 reported

A Demonstration of the Impact of Varying Parameters
Since the Smallwood and Thelander (2004) study is the only one known to the author using a string based measure of mortality, the direction and magnitude of mortality change as parameters are varied is not necessarily intuitive. It is not initially obvious, for instance, that the procedure can result in an estimate of annual mortality lower than the number of carcasses actually found (as in the cattle egret, below).

RESPONSE: Mortality estimates for species with only one carcass (such as the cattle egret), were not estimated by Smallwood and Thelander.

For all but the set-based comparison, variability added by the study duration was removed by using the mean duration in the calculations, and the turbines in Set 2 were considered the entire population.

Deaths per MW vs. Death per Turbine

Species	Carcass #	Deaths/Year (MW Basis)	Deaths/Year (Turbine Basis)
Brown-headed cowbird	1	6.1	1.9
Cattle egret	1	0.63	1.9
Common raven	1	2.4	1.9
Ferruginous hawk	2	9.3	3.8
Mountain bluebird	2	4.6	3.8

Search duration was set at the average (0.526 y) and total mortality (unadjusted) is only for Set 2.

Effect of Turbine Power Rating and String Length

Species	Carcass #	Turbines in String	Turbine kw	Deaths/year
Common raven	1	5	150	2.4
Ferruginous hawk	1	5	65	5.6
Mallard	1	6	100	3.2
Cattle egret	1	29	100	0.63

Search duration was set at the average (0.526 y) and total mortality (unadjusted) is only for Set 2.
Calculated by MW method.

Effect of Turbine Set on Total Mortality

Species	**Carcasses**		**Mortality (deaths/year)**		
	Set 1	**Set 2**	**Set 1 only**	**Set 2 only**	**Reported**
Golden eagle	15	10	34	163	116
Ferruginous hawk	0	2	0	38	24
Brown-headed cowbird	1	1	47	655	435
Mountain bluebird	2	2	49	310	216
Mallard	28	1	306	68	154
Homed lark	22	0	319	0	115

Total scavenging and searcher-corrected mortality for the entire Altamont using data only from set one, only from set 2, and as reported.

RESPONSE: We assume Weisskopf attempted to illustrate how extrapolating from Set 1 turbines yields different APWRA-wide mortality estimates than extrapolating from Set 2 turbines, although we admit we are not sure what Weisskopf attempted to communicate with these tables and this demonstration. If we assumed her intent correctly, then we agree separate extrapolations result in very different mortality estimates. One can see the differences in mortality estimates extrapolated from these two turbine sets by reading the Smallwood and Thelander (2005) final report to the National Renewable Energy Lab. These two turbine sets differ in substantial ways, such as different locations in the APWRA, different types of turbines, different ownerships, different land management practices, different elevation ranges, different topographies, different wind regimes, and likely additional differences. These differences are the reasons Smallwood and Thelander (2004) combined mortality estimates from the two turbine sets to arrive at a weighted average applied to the APWRA. Smallwood and Thelander possessed fatality data from both sets of turbines, not only one set or the other. (The NREL limited their analysis of data to those collected from Set 1 turbines, which is the Set studied under NREL funding.)

CLOSING RESPONSE:
In Attachment 3, Weisskopf seems to be disputing standard and widely accepted methods for estimating bird mortality in wind resource areas (see attachments documenting these practices). We can only assume that Weisskopf is unfamiliar with these common standards. In both Attachment 1 and 3, Weisskopf makes several errors in her analysis and makes misleading statements. Therefore, it is difficult to engage in a meaningful debate.

We understand that ranges in mortality estimates are large for small birds – that is the nature of the standard correction factors (which we did not develop). It is widely known that small birds (and bats) are easily missed by observers and more readily scavenged, which causes the correction factors for these species to create a larger range in mortality estimates. Additionally, the smaller the sample size, the more radically the adjustment factors will alter the magnitude of the estimate, resulting in increasingly larger ranges between the low and high adjusted mortality estimates. We are simply following protocol and applying professional judgement as called for in every leading document on determining avian mortality in wind farms, including the National Wind Coordinating Committee Guidelines.

Anderson et al. (1999) states: *The level at which fatalities are considered significant is subjective and will depend on the species involved. Even a small number of carcasses of a rare species associated with turbine strings may be considered significant, particular during the breeding season.* Clearly, data that documents just a few kills of a common bird species is of less importance to regulators than a large number of kills of a relatively rare or 'important' bird species. The primary focus in the APWRA has been raptors, and mainly golden eagles, burrowing owls, red-tailed hawks and American kestrels. So, while it is useful to document that over 30 bird species are represented in the fatality data, the Smallwood and Thelander fully recognize that the statistical power and the weight of the evidence varies from species to species, and that raptors were the primary focus of the project. Fortunately, raptors are among the most easily detected species killed in the APWRA, which results a relatively high degree of reliability in the results pertaining to those species.

Reporting the range of estimates as well as the actual number of fatalities gives the reviewer all the facts. Weisskopf could have made her argument using the lower range rather than the higher range, and not doing so was misleading. It is also misleading to omit the facts that 1) actual numbers of fatalities (not mortality estimates) were used to determine associations of casual factors leading to higher collision risk and 2) the majority of the report focused on developing methods to reduce collisions for those species that had high enough sample sizes to do so.

The mortality estimates that CalWEA and Weisskopf continue to focus on are merely estimates to better understand the magnitude of collisions and to compare between wind farm sites – these are based on standard protocol so comparisons can be more accurately determined.

A primary goal of the PIER- and NREL-funded research effort was to identify methods to reduce bird kills. To do so required quantifying several parameters. First, researchers needed to determine the approximate mortality for selected species, for raptors, for non-raptors, and for all birds combined. Next, they needed basic ecological data or physical information about the facility in order to identify by the use of basic modeling any associations that would lead to insights about why the mortality was not evenly (or randomly) distributed throughout the facility. These associations would then lead to recommendations on how to alter the landscape or the physical facilities to reduce bird, more specifically raptor, kills.

The high mortality of birds in the APWRA has been documented since the facility first opened. Many of the recent industry comments focus only on the high end of the range of values given as mortality estimates. It is important to remember that the authors presented a range of morality estimates and that even the lower range of those estimated values are alarming. Also, they are generally consistent with previous findings for the APRWRA for raptors (see Orloff and Flannery reports). No prior and credible research on non-raptors had ever been attempted there.

The absolute bird mortality may never be determined, especially for most bird species that are killed there. It is not essential that it be calculated with precision anyway. What is most important is that the estimates be defensible and their underlying assumptions be clearly stated, which the authors have done. It is, however, entirely justified to rely on these mortality estimates when interpreting the associations between where the birds are killed, what extent relatively to other facilities and between species, and within certain topographical or environmental or physical settings in the APWRA. The management recommendations that have emerged from this approach are all well documented, widely acknowledged as reasonable and credible, and they have generated recommendations that, if implemented, would very likely reduce bird kills. That was the stated goal of the research the CEC funded.

To argue over the efficacy of accepting/rejecting the highest values given within a range of mortality estimates entirely misses the point of why the estimates were developed in the first place. Debating the value that should be assigned to the highest end of the range of estimated mortality misses the larger, more relevant point of how can bird mortality be reduced given what we know. The Smallwood and Thelander (2004) document achieved its goal of providing those recommendations based on a sound scientific approach. It is now time to determine how to best implement these recommendations, monitor the effectiveness of these measures using sound, rigorous methodology, modify the measures as necessary to make them more effective, and overall, reduce bird kills in the Altamont.

Attempting to correct for Natural Mortality estimates is not necessary.

FINAL REPORT

AVIAN MONITORING STUDIES AT THE BUFFALO RIDGE, MINNESOTA WIND RESOURCE AREA: RESULTS OF A 4-YEAR STUDY

Prepared For:

Northern States Power Company
414 Nicollet Mall, 8th Floor
Minneapolis, Minnesota 55401

Prepared By:

Gregory D. Johnson, Wallace P. Erickson, M. Dale Strickland, Maria F. Shepherd and Douglas A. Shepherd

Western EcoSystems Technology, Inc.
2003 Central Avenue
Cheyenne, Wyoming 82001

September 22, 2000

documented during the study period, and wind development along Buffalo Ridge is not likely to jeopardize any of these species.

Although flight height data collected during the daylight period indicate that the larger Turbine B may pose less risk to some groups of birds than the smaller Turbine A, mortality data indicate that avian mortality rates per turbine are higher for Turbine B. Higher mortality at wind plants where Turbine B is in use likely supports our conclusion that nocturnal migrants are the primary avian group at risk on Buffalo Ridge, as the taller the structure, the greater the potential risk to nocturnal migrants (McCrary *et al.* 1984). Higher mortality associated with Turbine B also may be attributable to the much large rotor-swept area of Turbine B than Turbine A. Mortality data collected during this study suggest that the smaller (i.e., shorter) turbines have lower avian mortality.

Avian relative abundance on Buffalo Ridge is much higher in wetland and woodland habitats than in other major habitat types. For several groups of birds, there is also a significant relationship between abundance and distance to the nearest wetland or woodland. Avian mortality also increased with decreased distance to wetlands. Data collected during the 4-year study suggest that avian mortality would be reduced if turbines are sited as far away from woodlands and wetlands as possible.

Based on differences in avian densities among habitats on Buffalo Ridge, Leddy *et al.* (1999) suggested that land adjacent to turbines be maintained as cropland or pasture to reduce avian risk. CRP habitats are selected for by several species of grassland birds, and the abundance of CRP habitat in the Midwest has been credited with substantially increasing populations of numerous breeding species (Johnson and Schwartz 1993). Although croplands have the lowest avian use, our data indicate little difference in use among cropland, CRP and pasture. Furthermore, data collected during this study indicate that turbines placed in CRP habitats do not cause unacceptable levels of avian mortality. Therefore, conversion of CRP currently adjacent to operational turbines into crop fields or pasture may not be warranted. Permanently maintaining habitats adjacent to turbines in CRP could mitigate avian losses caused by turbines if increases in density of grassland species that select CRP habitats offset any decreases in avian abundance caused by turbine avoidance or turbine collisions.

The BACI analysis of both point count and RLB survey data indicated that use of the wind development areas following construction is lower than expected for several groups of birds. The area of reduced use occurs primarily in close proximity (i.e., $\leq$ 100 m) to turbines; however, the area of reduced use is larger for certain avian groups during some seasons. On a large-scale basis, reduced use by birds associated with windpower development appears to be relatively minor and would not likely have any population consequences on a regional level. One positive effect of reduced avian use around turbines would be reduced potential for collision mortality (Crockford 1992).

Over the course of the study, 24 avian fatalities were found while conducting 2,482 fatality searches on reference study plots. Approximately 45 minutes were spent searching each plot; therefore, one reference mortality was found for every 78 person-hours of searching. Based on the extreme effort required to document reference area mortality, we now feel that this study component is probably not warranted. Although some of the avian fatalities found associated with turbines may not have been caused by collisions, data collected through field examinations and laboratory necropsies indicate that most of the fatalities were likely turbine-related. If future avian mortality studies are conducted on Buffalo Ridge, conservative estimates of mortality should be made assuming all fatalities found associated with turbines are turbine-related. The amount of natural mortality occurring in the study area is so small that attempting to correct fatality estimates for natural mortality is not warranted.

Compared to several other wind plants in the U.S., data collected from 1996-1999 indicate that avian mortality is relatively low on Buffalo Ridge. At the P1 wind plant, no turbine-related avian mortalities were found in 1994 and seven were found in 1995 (Higgins *et al*. 1996). Our mortality estimates indicate an average mortality rate over the last four years of 0.98 birds/turbine in the P1 wind development area during the period 15 March to 15 November. Using this average, an estimated 72 avian fatalities may occur annually at this wind plant. The estimated number of bird fatalities per turbine in the P2 study area was 1.85 in 1998 and 2.68 in 1999. The estimated mortality rate for the P3 wind development area in 1999 was 4.45/turbine. Turbines used in the P2 and P3 area are typical of the large, newer-generation turbines currently being used on most wind plants throughout the U.S., and future windpower developments on Buffalo Ridge will likely have similar turbines. An average of the three turbine fatality estimates for this turbine type (two samples in P2 and one sample in P3) yields an estimate of 2.99 birds per turbine. Based on this average, annual mortality would be approximately 840 birds per year in the P2 and P3 wind plants combined. For every additional 100 turbines built on Buffalo Ridge in the future, an additional annual mortality of approximately 300 birds would be expected. Composition of future fatalities at Buffalo Ridge would likely be similar to that presented in Table 22.

Our data indicate that wind plant-related avian mortality on Buffalo Ridge primarily involves nocturnal migrants. Mortality of resident breeding birds appears very low, involves primarily common species, and would not likely have any population consequences within the Buffalo Ridge WRA. The estimated number of migrant fatalities can be put into perspective by examining the radar data collected on Buffalo Ridge by Hawrot and Hanowski (1997). Based on these data, an estimated 277 birds per hour passed by within a 1.4 km radius of the radar stations in the fall of 1996, and an estimated 260 birds per hour passed within a 1.4 km radius of the radar stations in the spring of 1997. Data were collected and averaged over a 14-hour period. Extrapolating the hourly estimates to the 14-hour sampling interval yields an estimate of 3,640 migrants/day during the spring migration and 3,878 migrants/day during the fall migration. Further extrapolation to cover the 48-day time periods included in each of the radar samples (26 March to 12 May and 12 September to 29 October) yields a total estimate of 174,720 migrants in the spring and 186,144 migrants in the fall within a 1.4 km radius (2.8 km wide front) of any given point on Buffalo Ridge. From east to west, the total width of the wind development (all three phases) on Buffalo Ridge is approximately 27.2 km. Assuming the radar collected are fairly representative of all of Buffalo Ridge, then the mean number of migrants potentially exposed to turbine collisions on Buffalo Ridge would be approximately 27.2 km/2.8 km X 174,720 = 1,697,280 in the spring and 27.2 km/2.8 km X 186,144 = 1,808,256 in the fall, or approximately 3,505,536 birds per year. Given this estimate, the number of avian migrant wind plant related fatalities on Buffalo Ridge is likely inconsequential from a population standpoint.

Bias Estimate Justification

WIND ENERGY/BIRD INTERACTIONS: A GUIDANCE DOCUMENT

METRICS AND METHODS FOR DETERMINING OR MONITORING POTENTIAL IMPACTS ON BIRDS AT EXISTING AND PROPOSED WIND ENERGY SITES

Prepared for the Avian Subcommittee and NWCC
December 1999

NATIONAL WIND COORDINATING COMMITTEE

example, a comparison of the number of bird fatalities per turbine among portions of a wind plant, between two turbine types, or among several wind plants, is much more meaningful if an estimate of bird abundance is added to the denominator.

There are a limited number of parameters that one can measure in a Level 1 study. The more likely parameter candidates and some potential risk indices are listed here and described below.

- bird utilization counts
- bird utilization rate
- dead bird search
- bird mortality
- removal rate
- observer bias
- detection bias.

There is little doubt that the presence of a wind plant will increase the risk of individual bird fatalities. This may be of great concern if the individual birds at risk have some special significance, as in the case of an extremely rare species. Risk of individual fatalities may be of interest when planning the design or location of a new wind plant, evaluating differences among turbine types, or when making modifications in equipment. *However, the risk of individual fatalities may not necessarily represent a risk to a population of birds.* Studies of risk to individuals and populations require separate study designs. Normally, Level 1 studies will be designed to make direct statistical and deductive inference to risk to individuals and indirectly indicate risk to populations. Level 2 studies normally will be needed to estimate risk to populations.

Metrics Definitions

Bird utilization counts. Utilization counts are indices of relative abundance among plots, areas, and seasons. Utilization counts represent observations of individual birds from an observation point or transect conducted repeatedly over some time period to document behavior and relative abundance of birds using the area. The observer counts the length of time the bird is within the plot and estimates "bird minutes" of use. The bird utilization counts allow comparisons among defined time periods (e.g., seasons, migration periods, or years), and areas. Bird activities should include behaviors which could be related to risk of injury or mortality from wind plants and might include flying, perching, soaring, hunting, foraging, height above ground, and behavior within 50 meters of WRA structures, etc. In situations of high bird density where it is impossible to keep track of all birds in a plot, use can be estimated for the observation period by making instantaneous counts repeatedly during the counting time period.

Bird utilization rate. This term refers to the number of birds observed or the number of bird minutes recorded per count period and/or survey plot. Like bird utilization counts, bird utilization rate may be used for comparisons among plots, areas, and seasons. One formula for utilization rate is

$$\frac{\text{\# birds observed}}{\text{time or time and area}} = \text{Bird Utilization Rate}$$

Utilization rates within specified distances of wind plant structures (e.g. large and small turbines, different tower types, etc.), subdivided on the basis of relevant environmental covariates (e.g. topographic features, vegetation edge, nesting structures, etc.) can be derived from the bird utilization counts. Rates can be developed for species, taxonomic groups, all birds observed, natural communities, seasons, distance from nearest turbine, turbine type, and other variables. Rates can be calculated for specific behaviors and risk can be evaluated in terms of the number of birds observed exhibiting behaviors that place them at greater risk. For example, birds flying at heights within the range of the rotor swept area are likely at greater risk than those consistently flying at heights above and below the rotor swept area. Evaluation of risk based on behavioral data can be used in a variety of studies of wind energy including relative comparisons of areas, turbines, and species. The choice of a utilization rate is critical; see discussion below.

Dead bird search. Searches are conducted in a defined area with complete coverage to detect bird fatalities. The number of dead birds found at each search site (e.g., a 50-meter diameter circle centered on the bird utilization count site) is documented. Information is collected which will aid in analysis later in the study. This may include bird species, sex, age, estimated time since death, cause of death, type of injury, distance and direction to nearest turbine, and distance and direction to nearest structure.

Bird mortality. The number of dead birds documented per search site may be termed "bird mortality."

This is the rate of fatalities. Examples of indices for bird mortality are:

$$\frac{\#\ \text{dead birds}}{\text{turbine}}, \quad \text{and} \quad \frac{\text{dead birds}}{\text{unit rotor swept area}}$$

Removal rate. This is the rate at which bird carcasses are removed by scavengers or by other means (e.g., human removal), resulting in their loss to detection by the dead bird search. Information about removal rates is necessary when estimating the total number of dead birds in a given area. The results are used to adjust the number of dead birds detected. This rate may be determined by placing a known number of bird carcasses at randomly chosen locations and monitoring them for removal. Removal rates can be calculated as a rate or rate/area. This allows for comparison of removal levels between different locations or subareas within the WRA. If not detected, significant removal rate differences would result in misleading bird risk rates. If removal rates in different areas within the same WRA or between WRAs are equal, they will have no effect when computing and comparing mortality rates, bird risk rates, and attributable risk rates.

Observer bias. Observer bias is a quantification of the observer's ability to find dead birds or detect live birds. One study might quantify the observer's ability to find dead birds when a known number of birds are placed in the search area. Another study might compare the field crew's live bird observations in order to determine inter-observer differences.

Detection bias. Detection bias is a measure of the differences in detection probability due to topography and vegetative structure. Detection bias may be determined through a designed study which includes placing a known number of dead birds in a variety of locations with differing topography and vegetative structure. The detection success can be quantified and the probability of detection determined.

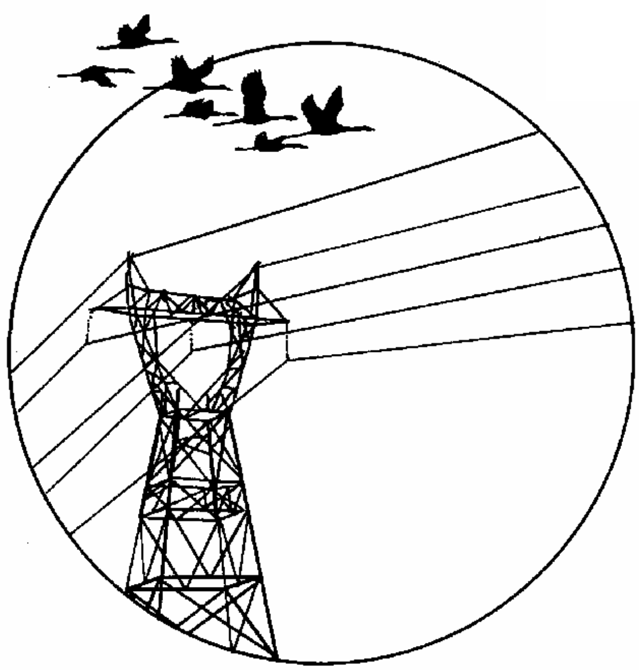
Defining Utilization

If risk is defined as the ratio of dead or injured birds to some measure of utilization, then the choice of the use factor, or denominator, is more important than the numerator (number of dead or injured birds). In fact, the treatment effect is usually small relative to the variability that would arise from allowing alternative measures of risk. The choice arises from the preliminary understanding of the process of injury or death. For example, should the denominator be bird abundance, bird flight time in the plant, bird passes through the rotor plane, or some other measure of use? Unless these measures are highly correlated with death — which may be unlikely — then the measure selected will result in quite different measures of mortality. Further, the choice of denominator should express the mechanism causing the injury or mortality. If it does not, then it cannot be used to accurately measure the effectiveness of a risk reduction treatment. There is, however, much uncertainty in the mechanism(s) leading to bird fatalities in wind plants.

Choice of utilization factor. Suppose that bird use or abundance is selected as the denominator, with bird deaths as the numerator, and painted blades as the treatment. A treatment-reference study determines that death decreases from 10 to 7 following the treatment, but use also decreases from 100 to 70 (arbitrary units). It thus appears that the treatment had no effect because both ratios are 0.1 (10/100 and 7/70). There are numerous reasons why bird use of a wind plant could change (up or down) that are independent of the blade treatment; for example, changes in prey availability, deaths on wintering grounds, environmental contaminants, change of land use, and so on. Thus, unless it can be established that there is a direct link between the number of birds using the area and flights near a turbine, this study may be seriously flawed. Recording bird flights through the rotor plane of painted blades would have yielded a more correct measure of effect. In addition, the use of selected covariates can help focus the analysis on the treatment effects. Naturally, the hypothetical study noted above should be adequately replicated if implemented. (See chapter 3 for recommendations on study design.)

Surrogate utilization variables. Utilization is an indicator of the level of at-risk behavior. Thus, adopting a measure of utilization requires the assumption that the higher the utilization, the higher the fatalities. It is, of course, prohibitive from a practical standpoint to record every passage of a bird through a zone of risk (be it a rotor plane or the overall wind plant). Further, it is usually prohibitive to accurately census the population and tally all deaths. Researchers must usually rely on surrogate variables to use as indices of population size and death. A *surrogate variable* is one that replaces the outcome variable without significant loss in the validity or power of the study. For example, researchers might use the number of birds observed during 10-minute point counts (i.e., the number of birds counted during a 10-minute observation period) as a measure of utilization (for either a treatment or reference case).

Mitigating Bird Collisions With Power Lines: The State Of The Art In 1994



Avian Power Line Interaction Committee
(APLIC)

EDISON ELECTRIC
INSTITUTE

carcasses. (When a dead bird is scavenged, a rather tight cluster of feathers [feather spots] remains.)

For each feather spot the following information should be noted:

- date
- species or group
- location.

In the Beaulaurier (1981) study, both dead birds and feather spots were used in estimating the collision mortality in relation to the number of flyovers. In certain cases, purported victims have lacked evidence of collision mortality; other factors may have been responsible for the mortality. When this occurs, some additional laboratory analysis (e.g., toxicological analysis) may be advised. In the study by Anderson (1978), fluoroscopy was used to detect lead pellets in dead birds, and the gizzard was examined to see whether it contained lead pellets.

Biases in Dead and Injured Bird Searches

Three early studies addressed the issue of biases in searches for dead and injured birds (Meyer 1978, James and Haak 1979, Beaulaurier 1981). In the Meyer (1978) study, at least three biases were identified that cause the underestimation of the number of dead birds found: search bias, removal bias, and crippling bias. Since Meyer (1978), James and Haak (1979), and Beaulaurier (1981) addressed the issue of "biases" in connection with dead bird searches, many authors have incorporated bias studies in their methodologies, so that the number of actual collisions is not underestimated (Willdan Associates 1981 and 1982, Faanes 1987, Anderson and Murphy 1988, Hugie et al. 1992, Hartman et al. 1992, Brown and Drewien 1995). Typically, studies should be undertaken to measure the four primary biases:

- search bias
- removal bias
- habitat bias
- crippling bias.

Search Bias

This bias affects the detectability of dead birds because of terrain, vegetation, and the searcher's ability and experience. To measure this bias, an assistant should randomly place dead birds in the search area. The normal dead bird search procedure should then be followed by another investigator (the individual being evaluated). The percentage of "planted" birds not found determines the search bias:

$$SB = (TDBF/PBF) - TDBF,$$

where SB = search bias, TDBF = total dead birds and feather spots found in the search area during the study (excluding those found during the initial search), and PBF = proportion of planted birds found during the plant/recovery study.

Hartman et al. (1992) calculated a separate estimate of dead birds for each specimen collected, because the calculated search bias varied as a function of the conspicuousness of the bird and because scavenger removal and habitat biases varied over time and location. Consequently, all biases and estimates were totaled separately for the four transects and years of their study.

Removal Bias

This bias occurs when scavengers remove dead birds before a search. To measure removal bias, a number of dead birds should be placed throughout the search area. Each day for a week, the condition of these birds should be monitored. Removal bias is the percentage of birds missing with no trace remaining, and is expressed by the following formula:

$$RB = (TDBF + SB)/PNR - (TDBF + SB),$$

where RB = removal bias by scavengers and PNR = proportion of "planted" birds not removed by scavengers. Raevel and Tombal (1991) and others have noted that removal bias varies with the size of the birds: smaller birds disappear more frequently and more quickly. This pattern was also noted in the Brown and Drewien (1995) study. Brown and Drewien found that crane carcasses sometimes remained for as much as a year after death, and that no crane carcasses were removed by scavengers during the removal studies. In contrast, passerines frequently disappeared overnight. Consequently, the effects of size must be included in calculations of removal bias and must be considered when planning a removal bias study.

Habitat Bias

This bias occurs when some portions of a study area may not be searchable because of water or dense vegetation. Investigators can estimate the percentage of unsearchable habitat from on-ground surveys using the following formula:

$$HB = (TDBF + SB + RB)/PS - (TDBF + SB + RB),$$

where HB = habitat bias, and PS = proportion of area that is searchable. Habitat bias should *not* be used as a replacement for field work. Researchers should not extrapolate beyond the area sampled, because conditions could cause the rate of collision to differ in different habitats. Habitat bias should be used only in very limited situations where unsearchable habitat is finely interspersed with searchable habitat and where the researchers can demonstrate that the numbers of birds found in searchable and unsearchable habitats are similar.

Crippling Bias

When some birds either fall outside the search area or fall in the search area, then move out of the area and subsequently die, they are missed by searchers. This miss factor is called crippling bias. In Beaulaurier's (1981) study, crippling bias was defined as the percent of observed collisions in which birds continued flying out of the study area after the collision. Because she did not observe a collision during her study, she used an estimate of 74%--the average of the measure of crippling bias calculated by Meyer (1978) as 75% and James and Haak (1979) as 73%. These authors assume a worst-case estimate, with all cripples dying ultimately from their injuries. Only data from a small sample of duck flights were used in the calculation. No data on small birds were used. The estimates are also based on collisions with groundwires, and the authors suggest that crippling estimates may be different for collisions with conductors. The adjustment for crippled birds can be calculated from the following formula:

$$CB = (TDBF+SB+RB+HB)/PBK - (TDBF+SB+RB+HB),$$

where CB = crippling bias and PBK = the proportion of observed collisions falling within the search area.

Because crippling bias estimates are extremely difficult to obtain (great time and effort are involved in monitoring flights and recording collisions), they are the least likely to be calculated in a study. However, the application of estimates from other studies may be inappropriate, and, in fact, very misleading. Once again, the size of the bird may make a significant difference because of flight dynamics. According to Brown (pers. comm.), a crane or swan that just tips a line is more likely to tumble to the ground and sustain fatal injuries than is a smaller, lighter bird that may be able to recover its flight in mid-air. Consequently, smaller birds might have a higher crippling bias than large birds. This possibility needs to be examined in future research.

Estimate of Total Collisions (ETC)

The estimate of total collisions (ETC) equals the total dead birds and feather spots found plus each of the estimates of the biases such that

$$ETC = TDBF + SB + RB + HB + CB.$$

Although this estimate has included HB and CB, these biases are optional and should be included only if credible numbers have been calculated on-site. The shortcomings of estimating HB and CB have been addressed above.

1994 National Avian-Wind Power Planning Meeting Proceedings

Suggested Practices for Monitoring Bird Populations, Movements and Mortality in Wind Resource Areas

by

Sidney A. Gauthreaux, Jr., Clemson University

Introduction

This paper emphasizes the needs for minimum standards in formulating study designs for measuring low-altitude bird movements, and conducting dead and injured bird searches within wind resource areas and at specific wind development sites during pre- and post-construction periods. If future studies use standardized protocols, comparisons between data sets will be facilitated, prediction of regional impacts of wind resource development on birds will be possible, and all will be accomplished in a more timely manner.

In order to accurately assess the environmental impact of a wind farm project, pre-construction studies are indispensable. The function of a pre-construction study is to document baseline conditions that can be used to predict (1) changes in the distribution and abundance of avian populations on and near the wind farm, and (2) collisions with wind turbine blades, towers, guy wires, and transmission lines in the project area. These baseline data are also essential for the quantification of the actual impact after development (Jones 1986).

Population Assessment Studies

Sampling Design and Statistical Analysis.—Once the utility or developer decides to conduct a pre-construction assessment of bird populations and movements, a sampling design must be chosen. Green (1979) provided a useful guide to sampling designs and statistical analyses for environmental studies. The design and associated statistical analyses can be set in a "spatial-by-temporal" framework that generates options (Green 1979). He suggests that an optimal impact study design must meet four prerequisites:

- the study must begin before the impact occurs, so before-impact baseline data can be collec provide a temporal control for post-impact data,
- the type of impact and time and place of occurrence must be known so a sampling design appro for the relevant tests of hypotheses can be devised,
- it must be possible to measure all relevant biological and environmental variables in associatio the individual samples, and
- an area that will not receive the impact must be available as a spatial control.

The first and last prerequisites dictate that controls in both space and time are necessary. The prerequisites also define a design with at least one time of sampling before impact and at least one after impact, at least two locations differing in degree of impact, and coordinated measurements of environmental and biological variables. The optimal impact study design is referred to as an "areas-by-times factorial design", and the appropriate

In some studies all birds found were photographed and a waterproof tag with an identification number was attached to each bird's leg. A marker indicated the position of each dead bird that was left in place so that rates of scavenger damage and removal and of decomposition could be measured. Feather spots were recorded and listed separately from birds. When a dead bird is scavenged by a raptor or coyote, a rather tight cluster of feathers (feather spots) remains. For each feather spot the following information should be noted:

- date
- species or group
- location

Both dead birds and feather spots can be used in estimating the amount of collision mortality in relation to the number of flyovers. In certain cases, dead birds may be found without firm evidence of collision mortality; other factors may have been responsible for the mortality. In such instances some additional laboratory analysis (e.g., toxicological analysis) may be advised. Fluoroscopy has been used to detect lead pellets in dead birds and gizzards have been examined to see if they contained lead pellets (Anderson 1978). Because some mortality at wind farms is not related to collisions or electrocution, a necropsy may be necessary to determine the probable cause of death. A veterinarian specializing in birds can be consulted. A state or federal wildlife agent will know who to contact for this service.

A data form for dead bird searches is given in Appendix 1 (see also Appendix Table 3).

Biases in Dead and Injured Bird Searches.—Three biases cause underestimation of the number of dead birds: search bias, removal bias, and crippling bias. The objective is to develop correction factors for biases, so that the number of actual collisions is not underestimated. In addition, some habitats (e.g. water) may be unsearchable, resulting in the need for a fourth correction factor for "habitat bias". In some wind turbine/bird mortality studies, efforts have been undertaken to measure these four biases (see Winkelman 1989, 1992a).

Search Bias: This bias represents the fact that not all dead birds present are detected during searches, given the effects of terrain, vegetation, and the searcher's ability and experience on detectability. To measure this bias an assistant should randomly place dead birds in the search area. The normal dead bird search procedure should then be followed by another investigator (the individual being evaluated). The percentage of "planted" birds not found determines the search bias:

$$SB = (TDBF/PBF) - TDBF,$$

where SB = search bias, TDBF = total dead birds and feather spots found in the search area during the study, excluding those found during the initial search, and PBF = proportion of planted birds found during the plant/recovery study. A separate estimate of dead birds for each species collected should be calculated, because the calculated search bias varies as a function of the conspicuousness of the bird and because scavenger removal and habitat biases often vary over time and location. In Winkelman's (1992a) study of 18 wind turbines, 18, 21 and 86 small birds were placed around the turbines and 39, 52 and 40 per cent were found in three different years. For large birds, 9 and 12 individuals were placed around turbines on the wind farm in two different years, and 89 and 75 per cent were recovered. This illustrates that correction factors for small and large birds must be calculated separately. The same is true for different habitats in the wind farm.

Removal Bias: This bias occurs when scavengers remove dead birds prior to a search. To measure removal bias, a number of dead birds is placed throughout the search area. Each day for a week, the condition of these birds should be monitored. Removal bias is the percentage of birds missing with no trace remaining and is expressed by the following formula:

$$RB = (TDBF + SB)/PNR - (TDBF + SB),$$

where RB = removal bias by scavengers and PNR = proportion of "planted" birds not removed by scavengers. Ravel and Tombal (1991) and others have noted that removal bias varies with the size of the birds such that smaller birds disappear more frequently and more quickly. This pattern was also noted by Brown and Drewien (1995). They found that crane carcasses sometimes remained for as much as a year after death and no crane carcasses were removed by scavengers during the removal studies. In contrast, passerines frequently disappeared overnight. Consequently the effects of size must be included in calculations of removal bias and must be considered when planning a removal bias study.

Habitat Bias: This bias occurs when some portions of a study area may not be searchable because of water or dense vegetation. Investigators can estimate the percentage of unsearchable habitat from on-ground surveys using the following formula:

$$HB = (TDBF + SB + RB)/PS - (TDBF + SB + RB),$$

where HB = habitat bias and PS = proportion of area that is searchable. Habitat bias estimates should not be used as a replacement for field work. Researchers should not extrapolate beyond the area sampled, because conditions could cause the rate of collision to differ in different habitats. Habitat bias estimates should be used only in very limited situations where unsearchable habitat is finely interspersed with searchable habitat and where the researchers can demonstrate that the numbers of dead birds occurring per unit area in searchable and unsearchable habitats are similar.

Crippling Bias: When some birds fall outside of the search area or fall in the search area, move out of the area, and subsequently die, they are missed by searchers. This miss factor is called crippling bias. Estimates need to be calculated for wind turbines of different designs. The adjustment for crippled birds can be calculated from the following formula:

$$CB = (TDBF+SB+RB+HB)/PBK - (TDBF+SB+RB+HB)$$

where CB = crippling bias; PBK = proportion of observed collisions falling within search area.

Crippling bias estimates are extremely difficult to obtain because of the effort required to witness an adequate sample of injury-causing collisions. Consequently, crippling bias is the least likely factor to be calculated in a study. However, the application of estimates from other studies may be inappropriate and may be very misleading. Once again, the size of the bird may make a significant difference because of flight dynamics considerations. Smaller birds might have a higher crippling bias than large birds. This possibility needs to be examined in future assessments of bird collisions with wind turbines and transmission lines.

Winkelman (1992a) reported that 17 per cent of the 76 collision victims she found in a study of 18 wind turbines during six spring and four autumn periods were wounded but still alive.

Estimate of Total Collisions (ETC).—The estimate of total collisions (ETC) equals the total dead birds and feather spots found plus each of the estimates of the biases such that

ETC = TDBF + SB + RB + HB + CB.

Although this formula includes HB and CB, estimates of these biases should be included only if credible numbers have been calculated on-site. The shortcomings of estimating HB and CB have been addressed above.

Collision Rate Estimate (CRE).—An important statistic in studies of bird collisions with man-made structures such as wind turbines and transmission lines is the collision rate estimate—the percentage of birds that collide with the structure relative to the number that pass the structure in the zone of risk. This estimate should be calculated for different species groups (e.g., raptors, songbirds), and must be calculated using the estimated total collisions (ETC) and the estimated total flights (TF) for the study period, multiplied by 100 to convert to a percentage:

CRE = (ETC/TF) x 100.

The method of computation of total flights (TF) is very important because there is tremendous variance in the way these data are collected. In general, only crossings at altitudes where collisions seem possible should be included. Winkelman (1992b) has emphasized that only those birds attempting to cross through the rotor of a turbine are at risk. She noted that, during daylight, 14 birds were observed trying to cross through the rotors and one of these (7%) collided. During twilight and darkness, 51 birds tried to cross the rotors and 14 (28%) collided. Because there are no hard and fast rules for defining at-risk crossings, and definitions of the zone of probable collision may vary, it should be standard practice to compute collision rate estimates for birds crossing within a narrowly defined altitudinal band (at-risk crossing) as well as for birds crossing within the broadly defined altitudinal band (all crossings).

Acknowledgements

This paper is a much abridged version of a suggested practices document that I have prepared with support from the Electric Power Research Institute, Palo Alto, California. I particularly appreciate the support and encouragement of Earl Davis and Ed DeMeo of EPRI. A full version will be published in the EPRI technical report series in 1996.

Literature Cited

Anderson, W.L. 1978. Waterfowl collisions with power lines at a coal-fired power plant. *Wildl. Soc. Bull.* 6 (2):77-83.

Avery, M.L., P.F. Springer and J.F. Cassell. 1977. Weather influences on nocturnal bird mortality at a North Dakota tower. *Wilson Bull.* 89(2):291-299.

Beaulaurier, D.L. 1981. Mitigation of bird collisions with transmission lines. Bonneville Power Admin.,

AMERICAN BIRD CONSERVANCY WIND ENERGY POLICY

I. ABC POLICY

Birders, ornithologists, and conservationists are debating whether to fully support the rapidly growing construction of wind turbines to generate clean electricity from a renewable source. Concerns have surfaced over the potential threat to birds and bats from the construction and operation of wind energy projects.

For decades, conservationists have urged a shift away from nuclear and fossil-fueled electrical generation to clean, renewable sources of power such as wind and solar energy. ABC supports the development of renewable energy in the U.S., including wind power, as an alternative to fossil-fueled power plants to meet the current and growing demand for electrical energy. In doing so, ABC recognizes that all energy choices have implications for birds.

B. BIRD MORTALITY

Bird and bat mortality is expressed throughout this policy statement as birds or bats/per turbine/per year. As wind energy turbines have become larger and able to produce much greater amounts of electricity per turbine, researchers have begun to express mortality in terms of birds or bats per MW generated per year. Unlike estimates for communication towers, mortality estimates for wind turbines have been adjusted upward from the whole carcasses and carcass parts (e.g., feather spots) that are found. This adjustment is made to account for incomplete searcher efficiency and scavenger/predator carcass removal.

http://www.abcbirds.org/policy/windpolicy.htm

Feather spot Justification

September 2004 • NREL/SR-500-36416

Subcontractor Report

Avian Monitoring and Risk Assessment at the Tehachapi Pass Wind Resource Area

Period of Performance: October 2, 1996 - May 27, 1998

R. Anderson, N. Neumann, and J. Tom
State Energy Resources Conservation and Development Commission
Sacramento, California

W.P. Erickson, M.D. Strickland, M. Bourassa, K.J. Bay, and K.J. Sernka
Western EcoSystems Technology, Inc.
Cheyenne, Wyoming

NREL

National Renewable Energy Laboratory
1617 Cole Boulevard, Golden, Colorado 80401-3393
303-275-3000 • www.nrel.gov

Operated for the U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
by Midwest Research Institute • Battelle

Contract No. DE-AC36-99-GO10337

Of the 75 fatalities found on search plots, the most commonly found avian group was other birds (40.0%, mostly unidentified birds) followed by raptors (34.7%), passerines (20.0%), and corvids (5.3%). These dead birds were found 0–50 m (mean = 20.4 m) away from the closest turbine. When the closest structure was a turbine, dead birds were found 0–50 m (mean = 16.8 m) away from the turbine.

Forty-four of the 127 fatalities (34.6%) were raptors (Table 11). Raptor species with the most fatalities were the red-tailed hawk (14), great horned owl (13), and American kestrel (9). Other raptor fatalities consisted of the common barn owl (2) and one each of the following the ferruginous hawk, prairie falcon, long-eared owl, flammulated owl, an unidentified buteo, and an unidentified raptor. Only two corvid species suffered fatalities, the common raven (8) and scrub jay (2), which represented 7.9% of the total. Twenty-seven of the fatalities (21.3%) were passerines. Passerine species with the most fatalities were the western meadowlark (6), horned lark (3), European starling (3), white-crowned sparrow (2), and dark-eyed junco (2). Other passerine fatalities consisted of one each of the chipping sparrow, Brewer's blackbird, hermit thrush, rock wren, yellow-rumped warbler, loggerhead shrike, and unidentified sparrow in addition to four unidentified passerine fatalities. Other birds comprised 46 (36.3%) of the fatalities. Other bird species with fatalities included the rock dove (11), mourning dove (6), red-shafted flicker (3), greater roadrunner (2), chukar (2), and California quail (2). Twenty fatalities remained unidentified to taxonomic group and were grouped in the other bird category. These were typically feather spots.

Seventy of the 127 fatalities (55.1%) were feather spots, 31 (24.4%) consisted of feathers and/or bones, 13 (10.2%) were intact and 12 (9.5%) were dismembered. Seventy-five of the 127 bird fatalities (59.1%) were found during scheduled carcass searches. The remaining fatalities were found by observers as they conducted other study activities or by power company employees (Appendix B). Only fatalities found during scheduled carcass searches were used to estimate fatality rates.

Fatalities were observed at 54 (27%) of the 201 sites monitored. The largest number of fatalities observed at any one site was four (sites Z18, Z36, Z44), with three fatalities observed at each of two sites, two fatalities at nine sites, one fatality at 39 sites, and no fatalities at the remaining sites. Based on the 75 fatalities observed at these sites, we would expect approximately 28% of the sites to have at least one fatality under a random distribution, which suggests there was no large distinctive clustering of fatalities at a few turbines. However, factors such as scavenging and the relatively small sample of turbines compared to the total number of turbines in the wind site could mask a clustering effect.

Turbines were the closest structure that could have caused the fatality for 97 of the 127 fatalities (76.4%). Turbines were the first or second closest structure for 118 fatalities (92.9%). Dead birds were found 0–350 m (mean = 25.1 m) away from the closest turbine. When the closest structure was a turbine, dead birds were found 0–75 m (mean = 16.9 m) away from the turbine. Thirty-six (28.3%) of the 127 fatalities were found <10 m from a turbine, 34 (26.8%) from 10 m to ≤20 m, 14 (11.0%) from 20 m to ≤30 m, 19 (15.0%) from 30 m to ≤40 m, 16 (12.6%) from 40 m to ≤50 m, and 7 (5.5%) were ≥50 m from a turbine.

Appendix B. **Fatalities found during carcass searches at Tehachapi Pass Wind Resource Area, 2 October 1996 to 27 May 1998. LLT = large lattice turbine; LTT = large tubular turbine; slt = small lattice turbine; stt = small tubular turbine; VAT = two-blade vertical axis turbine; ww = small windwall turbine**

Species	Geographic Location	Site[a]	Date	Condition	Distance from closest turbine (m)	Closest Structure	Comments
Unidentified Passerine	East Slope	S02	10/2/96	Feather spot	29	LTT	Many grey/brown fthrs. Approx 5 brown/grey flght fthrs w/ thin white fringe.
Red-Tailed Hawk	West Ridge		10/4/96	Dismembered	11	ww	Strong odor. flies on body. upper body gone. fthrs, bone, & dry flesh remain.
Common Barn Owl	East Slope	S04	10/7/96	Feather spot	23	stt	Feathers scattered over area 23 m @ 334 deg. from E13.
Unidentified Passerine	West Ridge	Z03	10/8/96	Feather spot	19	slt	Estimated time since death. (>100 body feathers & >15 flight feathers).
Rock Dove	West Ridge	Z03	10/8/96	Feather spot	9	slt	12 Feather dispersed along top (1.5 m high) of dirt rd side brim; along 3-m area.
Chukar	Middle Ridge	C03	10/8/96	Feather spot	15	stt	Numerous feathers found scattered over approx. a 15-m^2 area..
Red-Tailed Hawk	West Ridge		10/14/96	Feather spot	13	LLT	Found 14 m from 32-4 between in & 32-3. Coll. 2 blood and many body feathers.
Rock Wren	West Ridge	Z18	10/29/96	Feather spot	10	ww	Found 15 remiges and 10 downy feathers in a shrub while looking for fat. #8.
American Kestrel	West Ridge	Z18	10/29/96	Feather spot	12	ww	Found 10 tail feathers and several body feathers on ledge east of 4-36 & 4-37.
Great Horned Owl	West Ridge	Z18	10/29/96	Feather spot and/or bones	0	ww	Found many wing & body feathers around the bases of 4-35, 4-36, & 4-37.
Red-Tailed Hawk	West Ridge	Z48	11/1/96	Feather spot	5	LLT	Feathers w/in 50 m radius of perm. Study site Z48 as was found on 2/11/97 & 8/28/97.
Common Raven	Middle Ridge	C22	11/4/96	Feather spot	46	distribution line	Feather spot (approx. >25 flight feathers), area about 3 m x 4 m.
Great Horned Owl	Middle Ridge	C21	11/4/96	Feather spot and/or bones	50	stt	Feather spot approx. 1 m^2 (approx. 30 flight feathers & 1 bone fragment). 50 m @ 256 deg. from 9-20B.

Species	Geographic Location	Site[a]	Date	Condition	Distance from closest turbine (m)	Closest Structure	Comments
Unidentified Bird	West Ridge	Z22	11/6/96	Feather spot and/or bones	11	ww	Just bones. Old, partially buried. Vertebrae, leg, wing, pelvis.
Red-Shafted Flicker	West Ridge	Z22	11/6/96	Feather spot	20	ww	Many feathers.
Red-Tailed Hawk	East Slope	S03	11/14/96	Dismembered	11	LTT	Fresh kill a day or 2 at most. Head & lft wing sheared off.
White-Crowned Sparrow	Middle Ridge		11/15/96	Intact	35	other human-made structure	Cannon maint. office. Body fresh & somewhat warm. Possibly slammed into building.
Dark-Eyed Junco	Middle Ridge	C16	12/2/96	Intact	49	distribution line	Carcass shows no signs of trauma, but numerous small feathers on buckwheat found.
Horned Lark	East Slope		12/14/96	Intact	10	stt	Fnd 10 m from turb. base road; not hit by car. Most likely turbine kill - head crushed.
Common Barn Owl	Middle Ridge	C35	12/16/96	Feather spot	30	LTT	Fthrs very weathered. Poss scavenged coyote scat near fthrs apprx 10 flgt fth
European Starling	Middle Ridge	C21	1/21/97	Dismembered	1	stt	Fresh kill, likely w/in 24hrs. Decapitated near base of neck.
Western Meadowlark	Middle Ridge	C39	1/23/97	Feather spot	14	stt	Fthr spot of aprox. 1 m^2 area; >30 flt. fthers, >100 body fthers.
Unidentified Bird	West Ridge	Z42	1/29/97	Feather spot and/or bones	1	LLT	45 m from study center 22-7 LLT. One femur and 2 tibiotarsus.
Unidentified Bird	West Ridge	Z50	2/5/97	Intact	5	slt	Flght fthrs and partial skeleton (see data sheet). Fthrs weathered. 12-31-97.
Red-Tailed Hawk	West Ridge	Z52	2/21/97	Feather spot	40	ww	Found some feathers within and some outside the search site.
Great Horned Owl	West Ridge	Z60	2/24/97	Feather spot	2	ww	Cursory search. One fthr collected for species verification. Numerous widely scattered fthrs.
Red-Tailed Hawk	West Ridge	Z01	3/5/97	Intact	3	LLT	Numerous bones incl. complete rt. wing w/ flgt fthrs @ tip (6 indiv. fthrs).
Scrub Jay	West Ridge		3/10/97	Feather spot	7	LLT	Numerous body feathers and 6-10 flight feathers.

Species	Geographic Location	Site[a]	Date	Condition	Distance from closest turbine (m)	Closest Structure	Comments
Rock Dove	West Ridge	Z04	3/10/97	Feather spot	45	LLT	Numerous fthr (>100) scattered along side of rd & slopes.
Unidentified Bird	West Ridge	Z14	3/24/97	Feather spot and/or bones	7	LLT	Found legs, pelvic bone and a few ribs. Old & weathered.
Great Horned Owl	West Ridge	Z18	3/27/97	Dismembered	6	slt	Scavenged poss. by ravens: two carcass parts - wing and rest of body. Skull cap present but rest gone.
Chukar	Middle Ridge	C17	3/27/97	Dismembered	37	distribution line	Rt. wing, loose wing, tail,& body feathers. Fatality may have been recent.
Red-Tailed Hawk	West Ridge	Z21	4/1/97	Feather spot and/or bones	4	LLT	2 bone frags.
Loggerhead Shrike	Middle Ridge[2]		4/14/97	Intact	350	main road > 35 mph	Bird was hit by a vehicle at 20 mph coming down Cannon main entrance road.
Great Horned Owl	West Ridge		4/18/97	Intact	4	LLT	Observed during dead bird search at Permanent Site #Z27, LLT #27-13.
White-Crowned Sparrow	Middle Ridge		4/23/97	Intact	200	main road > 35 mph	Body was intact; bird might have been dead for 2-3 days; only eyes eaten by ants.
Red-Shafted Flicker	Middle Ridge	C25B	5/13/97	Feather spot	1	VAT	Found body fthrs & several retrices.
Mourning Dove	East Slope	S39	5/28/97	Feather spot	17	other human-made structure	Clusters of feathers found over square meter area. Some still had skin attached.
Common Raven[3]	West Ridge		6/3/97	Intact	15	main road > 35 mph	Found alongside main road, broken tailbone, no leg func, taken to rehab, died 6/5/97.
Great Horned Owl	East Slope	S42	6/9/97	Feather spot	30	stt	Group of primaries stuck together; several other wing feathers only had shafts left.
Unidentified Passerine	West Ridge	Z44	6/13/97	Feather spot	38	slt	Scattered fthrs (8 x 1 m area) in veg. along dirt road.
Mourning Dove	West Ridge	Z44	6/13/97	Feather spot	9	slt	Area of scatt. feathers was 29 m long & 1 m wide in veg. along dirt road.

Species	Geographic Location	Site[a]	Date	Condition	Distance from closest turbine (m)	Closest Structure	Comments
Mourning Dove	Middle Ridge	C48	6/17/97	Feather spot	6	stt	Found 50+ feathers, mostly along side of rd. or on rd. berm. Appears semi-recently graded.
Western Meadowlark	West Ridge	Z06	7/10/97	Feather spot and/or bones	11	slt	Found frag. of head and feathers alongside some breast skin-had yell. feath.
Red-Tailed Hawk	West Ridge		7/14/97	Feather spot	20	slt	Feathers along both sides of road at about 307 deg. from V136. Feathers fresh.
American Kestrel	West Ridge		7/16/97	Feather spot	40	slt	9 L. Wing feathers and several body feathers (good cond.) 54 m from site Z12 (V102 at 336 deg).
Red-Tailed Hawk	West Ridge	Z17	7/18/97	Dismembered	9	LLT	Found rt. wing, fthr spot, and pelvis & 2 partial legs in 3 places & fthrs. Scattered in area.
California Quail	Middle Ridge	C23	7/24/97	Feather spot	36	transmission line	Found fether spot; >50 feathers in a 10 X 5 area 36 m from site turb.
Unidentified Bird	West Ridge	Z66	7/29/97	Feather spot and/or bones	7	LLT	Found talons- tried to ID spp..Might be ACCI or PRFA. Also leg bones.
Unidentified Bird	West Ridge	Z64	8/6/97	Feather spot and/or bones	49	LLT	Found 1 humerus and 2 bone frags.
Common Raven	West Ridge		8/8/97	Feather spot	19	ww	About 19 m from turb. 19-5. Found about 20 remiges and some body feathers.
Unidentified Bird	West Ridge	Z27	8/12/97	Feather spot and/or bones	36	transmission line	Compared bones to GHOW-looks more like RTHA. Found coracoid, humerus, tibiotarsus. Also found tattered feathers.
Long-Eared Bat	West Ridge	Z23	8/12/97	Intact	3	slt	Found w/ fresh wound.
Great Horned Owl	West Ridge	Z28	8/13/97	Feather spot	3	ww	Feathers were around base of 6-43.Mostly body and down feathers.
Mourning Dove	East Slope	S26	8/18/97	Feather spot	38	fence	Found feather spot 38M @ 120 deg. from turb. K1.

Species	Geographic Location	Site[a]	Date	Condition	Distance from closest turbine (m)	Closest Structure	Comments
Common Raven	West Ridge	Z36	8/20/97	Feather spot	30	LLT	Feathers found. Looks like large bird. Body fthrs. >50 scattered semiplumes & other coverts.
Great Horned Owl	West Ridge	Z36	8/20/97	Feather spot and/or bones	47	meteorological tower	Partial wing collected, plus additional feathers. Both flight feathers and coverts collected.
Unidentified Bird	West Ridge		8/20/97	Feather spot and/or bones	35	fence	Found while doing a search @17-75; pneumatic femur, tibiotarsus, & tarsometatarsus.
Brewer's Blackbird	West Ridge	Z36	8/20/97	Feather spot	3	LLT	15 wing feathers (primaries and secondaries) and 20 body feathers collected.
American Kestrel	West Ridge	Z38	8/25/97	Feather spot	28	slt	Feather spot (>100 body and >6 flight feathers); scattered along both sides of road.
Rock Dove	West Ridge	Z44	8/27/97	Feather spot	49	other human-made structure	Found feathers 2 m from a dirt road & 32 m from barbed wire fence.
California Quail	West Ridge	Z46	8/28/97	Feather spot	4	ww	Mainly flight & body fthrs. Lg conc at base of 5-72 & some by 5-73. >50 fthrs & few diff fthrs.
Western Meadowlark	East Slope	S42	9/3/97	Feather spot and/or bones	3	stt	Found some of both wings and many wing and body feathers. Found 2 leg bones.
Unidentified Bird	West Ridge	Z21	9/3/97	Feather spot and/or bones	7	LLT	Fnd pieces of humerus, coracoid attach to sca-pula piece, during cnt 50 m from 22-16 @22-15.
American Kestrel	West Ridge	Z57	9/9/97	Feather spot	1	LLT	Fthrs were dispersed, but one area had high concentration, approx. 40 m from site at 20 deg.
Chipping Sparrow	Middle Ridge		9/10/97	Intact	55	transmission line	Skull cracked on back with hole. Dessicated inside cranium. Wing injury dorsal to rt. wing.
Great Horned Owl	West Ridge	Z02	9/23/97	Feather spot and/or bones	19	ww	Found some bones, part on one wing.

Species	Geographic Location	Site[a]	Date	Condition	Distance from closest turbine (m)	Closest Structure	Comments
Rock Dove	West Ridge		9/23/97	Feather spot	11	transmission line	Feathers strewn a long distance from near 3-24 toward 5-84.
Great Horned Owl	West Ridge	Z46	9/23/97	Feather spot and/or bones	5	ww	Strewn over a mod. area, many fthrs, part of lt wing, rt talon, lt talon att. to pelvis & vertebra.
Rock Dove	West Ridge	Z03	9/26/97	Feather spot	15	slt	Found many flight and body feathers. One clump of feathers had a skin partial at tip.
Mourning Dove	West Ridge	Z02	9/30/97	Feather spot	2	ww	Fthr spot found at NE corner of base of 3-28. fthr area approx 1 ft^2 @ 13 deg from ctr.
American Kestrel	West Ridge	Z06	10/1/97	Feather spot	14	slt	The few greyish coverts and tail feathers indicated that this individual was a male.
American Kestrel	West Ridge	Z08	10/7/97	Feather spot	8	ww	Fthr spot: 5 m X 3 m; >30 wing & tail fthrs. Some fthrs weathered and/or with broken shafts.
Unidentified Bird	West Ridge		10/16/97	Feather spot	60	distribution line	Found 4 remiges with a few coverts still attached to piece of ulna. Passerine-sized bird.
Western Meadowlark	East Slope	S16	10/20/97	Feather spot	16	stt	Feather spot (>100 contour & some flight feathers) in 5 m X 3 m area. 43 m from site turbine.
Unidentified Bird	West Ridge	Z23	10/22/97	Feather spot and/or bones	3	slt	Keel was found. Also found 6 ribs attached to different pieces of the sternum.
Western Meadowlark[d]	West Ridge		10/22/97	Not applicable	93	meteorological tower	Saw it hit guywire of MET. Landed nearby. As I approached, it flushed & flew away, flew fine.
Common Raven	West Ridge		10/23/97	Dismembered	14	slt	Most of ft. forearm & seconds, some radius & ulna expsd, distal gone, blood fresh @trauma.
Unidentified Passerine	East Slope	S20	10/23/97	Feather spot	40	LTT	Feather spot around juniper.

Species	Geographic Location	Site[a]	Date	Condition	Distance from closest turbine (m)	Closest Structure	Comments
European Starling	West Ridge	Z24	10/23/97	Feather spot	21	LLT	Feather spot, 1-3 m from side of dirt road to turbine. >100 body feathers & <15 flt feathers.
Hermit Thrush	West Ridge		10/24/97	Intact	15	other human-made structure	Fresh kill, blood was fresh and neck was loose. Eyes are gone.
Great Horned Owl	West Ridge		10/27/97	Dismembered	30	slt	Partial rt. wing (below hum.) with some prims. att. rad. & uln. expsd, no mscle, skin or fthrs. lg. fthr spot both side rd.
Common Raven	West Ridge	Z58	10/28/97	Feather spot	0	ww	Found several body and flt feathers in area around site Z58; main clump 41 m from 17-46.
Unidentified Bird	East Slope	S21	10/28/97	Feather spot and/or bones	30	LTT	Bone has marks as if sm mammal had gnawed on it.
Rock Dove	West Ridge	Z27	10/29/97	Feather spot	33	transmission line	Fthrs scattered along base of slope between 27-13 and 27-14. 6 remiges & 13 other feathers.
Yellow-Rumped Warbler	West Ridge	Z27	10/29/97	Feather spot	33	transmission line	8 retrices and 3 contour-type fthrs at base of slope between 27-13 and 27-14 in 1 m^2 area.
Rock Dove	West Ridge	Z03	10/30/97	Feather spot	3	slt	Feathers spread from 3 m away from turbine to 35 m away. Found during util count.
Flammulated Owl	West Ridge	Z70	10/30/97	Feather spot	10	slt	Fthrs collected = 100+ (includes 12+ remiges).
Red-Tailed Hawk	West Ridge	Z33	10/31/97	Dismembered	14	LLT	Coll pair of wings and other fthrs. Flesh on wings vry fresh, wings flex., torso devoured.
Dark-Eyed Junco	Middle Ridge		11/6/97	Feather spot	59	meteorological tower	Found sev. flt. and body fthrs 59 m from site C62 & 9m from guywire of MET - likely coll.
Unidentified Bird	West Ridge	Z34	11/7/97	Feather spot and/or bones	14	ww	Large raptor-sized sternum approx. 14 m from 18-27 @ 290 deg.

Species	Geographic Location	Site[a]	Date	Condition	Distance from closest turbine (m)	Closest Structure	Comments
Greater Roadrunner	West Ridge	Z36	11/11/97	Feather spot and/or bones	25	meteorological tower	Feather area was at edge of main access rd - maybe hit by vehicle.
Unidentified Raptor	West Ridge		11/17/97	Feather spot	75	ww	Feather spot of >65 contour feathers. 100M @ 227 DEG. FROM 6-65.
Common Raven	West Ridge		11/19/97	Feather spot	1	ww	Found 12 flt feathers and 5 body feathers 17 m from turb. 16-48 near base of a rabbitbrush.
American Kestrel	West Ridge	Z39	11/20/97	Feather spot	0	LLT	Found approx. 70 body feathers and 2 remiges at base of turb. 23-3.
Scrub Jay	West Ridge	Z39	11/20/97	Feather spot	7	LLT	Found 10 flt. feathers and 3 coverts just outside base of turb. #23-3.
Rock Dove	West Ridge	Z44	12/1/97	Feather spot and/or bones	46	slt	Found >70 body & flight feathers & 3 bone frags in an area 57 m from turb. #V265 (Z44).
Unidentified Bird	West Ridge		12/2/97	Feather spot and/or bones	40	slt	Left and fight femurs 51 m from V209. lt femor had hole in end.
Red-Tailed Hawk	East Slope		12/3/97	Dismembered	26	distribution line	Found dead by S.W. emp. in AM on ground next to D-Line pole; had electric burn on rt talon.
Great Horned Owl	East Slope		12/3/97	Intact	26	distribution line	Found dead on platform of D-Line pole in AM by S.W. emp. No obvious signs of electrocution.
Long-Eared Owl	East Slope	S34	12/4/97	Feather spot	39	stt	Approx. 100 body fthrs. Parts of bill found in fthr area. 39 m from D28 @ 100 deg.
European Starling	West Ridge		12/4/97	Intact	30	meteorological tower	Found lying on back, wings folded, tail slightly splayed, legs extended, no sign of injury, fresh.
Unidentified Bird	West Ridge	Z60	12/20/97	Feather spot and/or bones	15	ww	At 3 main areas: talons, leg bones, coracoids, scapulae, partial vertebral col, 1 rib, & hum.
Unidentified Buteo	West Ridge	Z54	12/29/97	Feather spot and/or bones	28	LLT	Old & weathered raptor skull 28 m from 22-1; no feathers or other bird bones.

Species	Geographic Location	Site[a]	Date	Condition	Distance from closest turbine (m)	Closest Structure	Comments
Rock Dove	West Ridge	Z03	12/31/97	Feather spot and/or bones	27	slt	>150 fthrs (remiges, retrices, & body fthrs). Femur, radius, & ulna cleaned of all flesh.
American Kestrel	West Ridge	Z63	12/31/97	Feather spot	3	ww	Found at least 20 (probably more) body fthrs around base of 5-116.
Western Meadowlark	West Ridge	Z76	12/31/97	Feather spot	32	LLT	>200 flt. & body feathers beneath a clump of pines and amidst tumbleweeds.
Horned Lark	East Slope	S02	1/6/98	Feather spot	18	LTT	>500 body & flt. fthrs in 1 large fthr spot, some may still be there.
Red-Tailed Hawk	East Slope	S05	1/6/98	Feather spot	12	LTT	Found 7 remiges, 14 add'l wing coverts and a few body fthrs. Several remiges - broken tips.
Ferruginous Hawk	East Slope	S02	1/6/98	Feather spot	43	meteorological tower	23 body fthrs inside circle & 32 outside.1.
Unidentified Bird	West Ridge	Z02	1/8/98	Feather spot and/or bones	26	meteorological tower	Possible TUVU/GOEA bones. Keel, part of pect girdle, 2 vertebrae & other bones near 3-28.
Mourning Dove	West Ridge	Z12	1/21/98	Feather spot	31	slt	5 Right remiges (probably all primaries) & 7 small UNID fthrs collected.
Rock Dove	West Ridge	Z65	1/26/98	Feather spot	46	telephone line	28 weathered flight fthrs (includes remiges, retrices, & <5 coverts).
Red-Tailed Hawk	West Ridge		1/27/98	Dismembered	10	ww	Pair of wings & adult rufous tail. Gnawed bones. Flexible skin w/ sticky, very red blood.
Great Horned Owl	East Slope	S16	2/5/98	Feather spot	47	distribution line	4 remiges from same wing. Also found 2 smaller fthrs. 2 pieces of fthrs, and 1 rachis tip.
Greater Roadrunner	East Slope	S17	2/5/98	Feather spot	41	LTT	Approx 100 fthrs, inc. 8 retrices, 22 remiges, and numerous wing coverts & contour fthrs.
Red-Shafted Flicker	West Ridge	Z20	2/5/98	Feather spot	21	slt	Feather spot, 25 wing & tail feathers & 7 contour feathers.

Species	Geographic Location	Site[a]	Date	Condition	Distance from closest turbine (m)	Closest Structure	Comments
Red-Tailed Hawk	West Ridge	Z23	2/27/98	Dismembered	13	slt	Found femur, tibiot, lt wing, ruf. tail fthrs. may have missed some fthrs. prob scav by birds.
Horned Lark	West Ridge	Z30	3/4/98	Feather spot and/or bones	17	LLT	Approx 50 contour feathers & 7 brown remiges.
Unidentified Bird	West Ridge	Z33	3/4/98	Feather spot and/or bones	26	LLT	7 wthered remiges att., 11 brkn shfts of remiges att. to hum. w/ ends of coracoid & scapula att.
Unidentified Sparrow	West Ridge	Z37	3/11/98	Feather spot	17	ww	>100 body feathers (many downy) & approx 12 remiges.
American Kestrel	West Ridge	Z36	3/23/98	Feather spot	6	LLT	Believe most larger fthrs coll, some small fthrs might still be present.
Unidentified Bird	West Ridge	Z36	3/23/98	Feather spot and/or bones	13	LLT	Found old humerus, probably from raptor.
Prairie Falcon	Middle Ridge	C48	3/24/98	Feather spot	18	stt	4 retrices (2 attached together by dried skin). Each w/ dried skin at end of each quill).
Unidentified Bird	West Ridge	Z49	4/9/98	Feather spot and/or bones	46	ww	Old bleached sternum (probably RAPT, possibly GHOW/RTHA).
Unidentified Bird	West Ridge		4/23/98	Feather spot and/or bones	31	slt	Fragmented withered bones outside of search area of site Z53. Prob. at least 1 humerus or femur.
Common Raven	West Ridge		4/23/98	Feather spot	11	ww	Feathers old & withered. About 15 flt fthrs (mostly primaries) w/in 1.5-m area. Large black feathers.

[a] Null value for site indicates fatality found outside of permanent sites.

[b] West of Sea West - area between Cannon and Sea West.

[c] Found alive but later died from injuries.

[d] Observed alive - flew away apparently unharmed.

Nine Canyon Wind Power Project
Avian and Bat Monitoring Report

September 2002 – August 2003

Prepared for:

Nine Canyon Technical Advisory Committee
Energy Northwest

Prepared by:

Wally Erickson
WEST, Inc.
2003 Central Ave.
Cheyenne, WY 82001

and

Karen Kronner and Bob Gritski
Northwest Wildlife Consultants, Inc.
815 NW 4th Street
Pendleton, Oregon 97801

WEST, Inc.
Specializing in Ecological Field Studies

Northwest Wildlife
Consultants, Inc.

October 2003

FIELD METHODS

The fatality monitoring study began once all the turbines were constructed and operational (early September). The following dates were used to define seasons: (1) spring migration (March 16 - May 15); (2) breeding season (May 16-August 15); (3) fall migration (August 16-October 31) and (4) winter (November 1-March 15).

Standardized Carcass Searches

Personnel trained in proper search techniques conducted the carcass searches at the turbines and the permanent meteorological tower. Boundaries of rectangular plots were delineated along each turbine string. All areas within a minimum of 90-m from turbines were searched[2]. Transects were set at 6 m (20 feet) apart, and searchers walked at a rate of approximately 45 to 60 m (148 to 197 feet) a minute along each transect searching both sides out to 3 m (10 feet) for casualties (Johnson *et al.* 1993). Search area and speed were adjusted by habitat type. It took approximately 1.5 to 2 hours to search each turbine depending on the habitat type. Searches were conducted twice monthly in the spring, summer and fall and once monthly in the winter, resulting in 19 searches at each of the 37 turbines. A complete round of searches (all turbines searched) took approximately 4 to 5 days to complete, depending on the number of searchers.

The condition of each carcass found was recorded using the following condition categories: (1) Intact – a completely intact carcass that is not badly decomposed, and showing no sign of being fed upon by a predator or scavenger; (2) Scavenged – an entire carcass which shows signs of being fed upon by a predator or scavenger, or a portion(s) of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin, etc.), and (3) Feather Spot - 10 or more feathers, or two primary feathers at one location indicating predation or scavenging.

All carcasses found were uniquely labeled, bagged and frozen for future reference and possible necropsy. A copy of the data sheet for each carcass was stored with the carcass at all times. Data recorded included species, sex and age (when possible), date and time collected, location, condition, and any comments that may indicate cause of death. All casualties were photographed as found. Casualties or fatalities found incidentally and not during formal searches were documented using a wildlife incidental reporting system (see next section). When non-study personnel discovered wildlife carcasses, a biologist was contacted to identify and collect the casualty. Appropriate wildlife salvage permits were obtained from the Washington Department of Fish and Wildlife and the U.S. Fish and Wildlife Service.

RESULTS

Bird Casualties

No casualties of federal or state-listed species were found during the study. Thirty-eight avian casualties representing 13 species[3] were found within search plots during the study (Table 1). Six casualties were non-native species. One heavily scavenged avian carcass (rough-legged hawk) was found a long distance (200 m) from the turbines, and was excluded from the analysis. Two of the 38 casualties were flightless young found away from the roads, and were therefore not considered collision fatalities. Only the remaining 36 were used in subsequent analyses. Eight of the 36 fatalities were intact, 13 were dismembered and scavenged, and the remaining 15 were feather spots. No fatalities were observed at the permanent meteorological tower. The thirty-six fatalities were observed at 21 different turbines (Table 2, Figure 5). The maximum number of fatalities observed during this period nearest any one turbine was 3 (Turbines 2, 4, 16 and 37). Two fatalities were found at 7 different turbines, and one fatality was observed at 10 different turbines. It was assumed that the fatalities occurred at the turbine nearest the carcass.

The most common fatality was horned lark (17 fatalities, 47% of total), which is a very common resident bird (Figure 6). Horned larks are also the most common fatality observed at the Stateline Wind Project, which is located approximately 12 miles southeast of the Nine Canyon Wind Project area (Erickson *et al*. 2003). Ring-necked pheasant (5 fatalities, 14% of total) and western meadowlark (2 fatalities, 6% of total) were the only other species with multiple fatality records. All five ring-necked pheasant casualties were feather spots. Two of the five feather spots were found at a potential roost site, which suggests they may not have been fatalities. Other fatalities found were one American kestrel, European starling (*Sturnus vulgaris*), great blue heron (*Ardea herodias*), red-breasted nuthatch, ruby-crowned kinglet (*Regulus calendula*), short-eared owl (*Asio flammeus*), spotted towhee (*Pipilo maculates*), Virginia rail (*Rallus limicola*), winter wren (*Troglodytes troglodytes*), and yellow-rumped warbler (*Dendroica coronata*). There were also two unidentified passerine feather spots observed within search plots.

The winter wren, yellow-rumped warbler, spotted towhee, ruby-crowned kinglet, and red-breasted nuthatch were most likely migrants. Virginia rails are found year-round in the Tri-Cities area in wetland habitats. It is unclear whether the rail was migrating through the project area, or a local resident that was moving between suitable habitat. There is no suitable habitat for this species near the project site. The American kestrel found in the middle of November had been heavily scavenged and scattered suggesting it was possibly dragged by farm equipment. The short-eared owl was intact. The average

[3] 13 identifiable species and four unidentified passerine feather spots

Subcontractor Report

January 2003 • NREL/SR-500-32840

Comparison of Avian Responses to UV-Light-Reflective Paint on Wind Turbines

Subcontract Report
July 1999 – December 2000

D.P. Young, Jr., W.P. Erickson,
M.D. Strickland, R.E. Good, and
K.J. Sernka
Western EcoSystems Technology, Inc.
Cheyenne, Wyoming

National Renewable Energy Laboratory

1617 Cole Boulevard
Golden, Colorado 80401-3393

NREL is a U.S. Department of Energy Laboratory
Operated by Midwest Research Institute • Battelle • Bechtel

Contract No. DE-AC36-99-GO10337

Avian Mortality

Carcass Searches

The objective of the carcass searches was to compare mean number of carcasses by species and groups of species between turbines with UV-reflective paint and conventional paint.

A detailed study of avian fatalities at the first construction unit (FCR I) has been conducted since the fall of 1998 (Young *et al.* 2001). Data from this study were used to estimate the number of avian fatalities associated with the FCR I turbines. The search protocol was expanded to cover FCR II (UV) and FCR III (non-UV painted turbines). The same level of effort was used in all areas.

A fatality rate (mortality) was calculated as the number of carcasses/turbine/search. All carcasses located within areas surveyed, regardless of species, were recorded and a cause of death determined, if possible, based on field examination. Carcasses found within 60 m of a turbine whose cause of death was undetermined (e.g., feather spots) were considered turbine related.

Carcass removal trials were used to estimate the carcass removal rate. The carcass removal rate is not necessary for comparing the effects of UV paint on mortality, but it does influence the power of the statistical tests for making such comparisons. If the time interval between the carcass searches is much greater than the average length of time a carcass remains in an area before being removed, then it is estimated that a small percentage of the carcasses is likely to be detected by observers. Therefore the power to detect differences between treatments will be low, especially with few carcasses detected. Searcher efficiency trials were also conducted to evaluate the effectiveness of the searchers. Low detectability would have similar effects on power, as would high scavenger rates relative to the interval between searches.

Searches of all turbine strings were conducted every 28 days to locate and collect any carcasses found under the turbines; however, carcasses found at other times and places were also recorded as incidental carcass discoveries. For all carcasses found, data recorded included species, sex and age when possible, date and time collected, location, condition (e.g., intact, scavenged, feather spot), and any comments that indicated cause of death. All carcasses located were photographed as found and mapped on a detailed map of the study area for future reference and permit-reporting requirements.

The condition of each carcass found was recorded using the following condition categories:

- Intact: Carcass is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger.

- Scavenged: At least a portion of the carcass shows signs of being fed upon by a predator or scavenger or portion(s) of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin, etc.).

- Feather spot: A group of feathers at one location indicating predation or scavenging. If only feathers are found, 10 or more total feathers or two or more primaries must be discovered to be considered a carcass.

SMUD Solano Wind Project
Phase 1 and Phase 1A
Avian Mortality Monitoring:
Methodology and Raw Data

Preliminary Administrative Draft

Prepared for the
Solano County TAC Meeting
March 17, 2005
(Revised May 2005)

Prepared by:

URS

2870 Gateway Oaks Drive, Suite 300
Sacramento, California 95833

6. On the Casualty Information Form, all remains found are classified based on their condition, as follows.

   Injured – A live bird incapable of sustained flight, with obvious injuries. In the event a live, injured bird is encountered, the bird will be collected and transferred to a rehabilitation facility. The details of this find should be recorded using the same procedure used to record fatalities. Specifically, the bird should be placed in a cardboard box with the lid closed, and the box should be stored in a cool location, such as the field trailer. A call should be made to Vivian Gaddie of URS and Sierra Wildlife Rescue (SWR), the point of contact for bird rehabilitation. At the end of the field day, the bird should be transferred to SWR at the URS office in Sacramento or at the SWR facility in Placerville.

   Intact – A carcass that is completely intact, not badly decomposed, and has no sign of being fed upon by a predator or scavenger.

   Scavenged – An entire carcass showing signs of being fed upon by a predator or scavenger.

   Dismembered – Part(s) of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin, etc.).

   ***Feather Spot** (birds only)* – Ten or more total feathers (or at least two primaries) at one location.

Carcasses are transported to a lockable freezer that is dedicated to the storage of remains found by searchers and, incidentally, by other wind project personnel. The freezer is located in the Solano Wind Project Phase 1 site field trailer. A United States Fish and Wildlife Service (USFWS) agent collects carcasses after the completion of the surveys. The URS field leader notifies the USFWS agent of the results of each survey.